

AD-A131 753

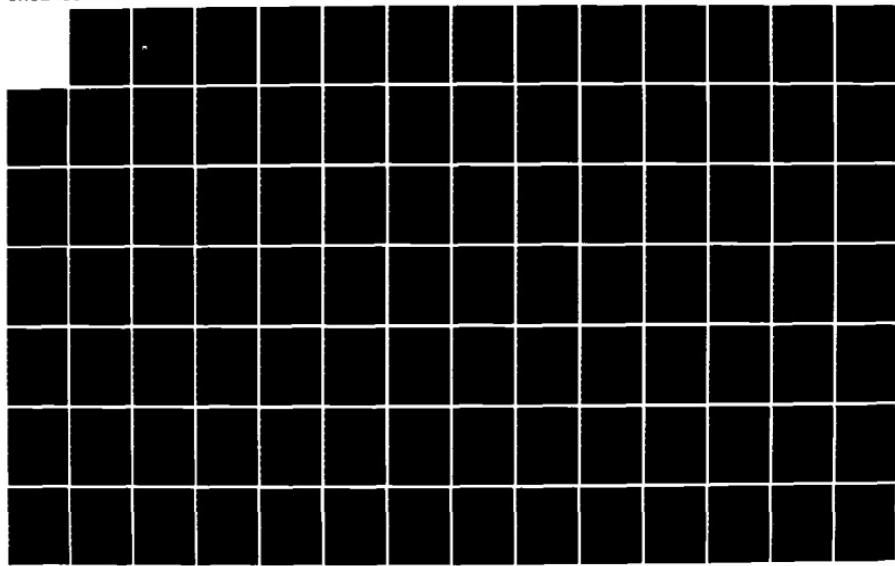
PULSED POWER BIBLIOGRAPHY VOLUME 2 ANNOTATED
BIBLIOGRAPHY(U) AIR FORCE WEAPONS LAB KIRTLAND AFB NM
J BEMESDERFER ET AL. AUG 83 AFWL-TR-83-74-VOL-2

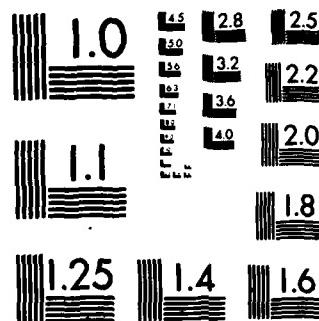
1/3

UNCLASSIFIED

F/G 20/5

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD/A131 753

AFWL-TR-83-74, Vol. II

AFWL-TR-
83-74
Vol. II

ADA131753

PULSED POWER BIBLIOGRAPHY

Volume II of II
Annotated Bibliography

Editors:

J. Bemesderfer
R. L. Druce
B. Frantz
A. H. Guenther
M. Kristiansen
J. P. O'Loughlin
W. K. Pendleton

August 1983

Final Report

Approved for public release; distribution unlimited.

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base, NM 87117

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

AFWL-TR-83-74

This final report was prepared by the Air Force Weapons Laboratory, Kirtland Air Force Base, New Mexico, under Job Order 999300CA. Lieutenant Colonel Winston K. Pendleton (CA) was the Laboratory Project Officer-in-Charge.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report has been authored by employees of the United States Government. Accordingly, the United States Government retains a nonexclusive, royalty-free license to publish or reproduce the material contained herein, or allow others to do so, for the United States Government purposes.

This report has been reviewed by the Public Affairs Office and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

If your address has changed, if you wish to be removed from our mailing list, or if your organization no longer employs the addressee, please notify AFWL/CA, Kirtland AFB, NM 87117 to help us maintain a current mailing list.

This report has been reviewed and is approved for publication.

Winston K. Pendleton

WINSTON K. PENDLETON
Lt Col, USAF
Project Officer

FOR THE COMMANDER

Arthur H. Guenther

ARTHUR H. GUENTHER
Chief Scientist

DO NOT RETURN COPIES OF THIS REPORT UNLESS CONTRACTUAL OBLIGATIONS OR NOTICE ON A SPECIFIC DOCUMENT REQUIRES THAT IT BE RETURNED.

DISCLAIMER NOTICE

**THIS DOCUMENT IS BEST QUALITY
PRACTICABLE. THE COPY FURNISHED
TO DTIC CONTAINED A SIGNIFICANT
NUMBER OF PAGES WHICH DO NOT
REPRODUCE LEGIBLY.**

AD-A131 753

Pulsed Power Bibliography Volume II of II Annotated Bibliography

**Air Force Weapons Laboratory
Kirtland Air Force Base, NM**

Aug 83

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFWL-TR-83-74, Vol II of II	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PULSED POWER BIBLIOGRAPHY Volume II - Annotated Bibliography		5. TYPE OF REPORT & PERIOD COVERED Final Report
7. AUTHOR(s) Editors: J. Bemesderfer A. H. Guenther W. K. Pendleton R. L. Druce M. Kristiansen B. Frantz J. P. O'Loughlin		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Force Weapons Laboratory (CA) Kirtland Air Force Base, NM 87117		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62601F/999300CA
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Weapons Laboratory (CA) Kirtland Air Force Base, NM 87117		12. REPORT DATE August 1983
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This report consists of the following volumes: I. Indices II. Annotated Bibliography		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Pulsed Power Insulation Breakdown Studies Particle Beam Generation Diagnostics Power Conditioning Energy Storage Switching		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Pulsed power and high-voltage technologies are playing an ever increasing role in weapons' effects simulation, fusion power research, power distribution, materials processing and medical research. It is a rapidly expanding field of applied physics as evidenced by the growth in published literature. Three years ago, the Air Force Weapons Laboratory (AFWL) initiated a project to compile a computerized data base of pulsed power research papers. The data base is stored on our IBM System 2000. This AFWL Technical Report is the first release of the (over)		

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

20. ABSTRACT (Continued).

bibliography to date. It contains about 2,500 full bibliographic citations, original sources, availability, key words and abstracts. There are three indices: Subject, Personal Author, and Corporate Author. There are 30 main subject headings, from Breakdown Studies to Switching. The indices are contained in Volume I. Volume II contains the citations. In addition to these entries, the data base contains about 7,500 additional titles. As these titles are added to the full bibliography, they will be published.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED
FROM THE BEST COPY FURNISHED US BY
THE SPONSORING AGENCY. ALTHOUGH IT
IS RECOGNIZED THAT CERTAIN PORTIONS
ARE ILLEGIBLE, IT IS BEING RELEASED
IN THE INTEREST OF MAKING AVAILABLE
AS MUCH INFORMATION AS POSSIBLE.

ABSTRACT

100
(PARTICLE BEAMS, ION)
(Generation)

GENERATION OF ULTRA-INTENSE HEAVY ION BEAMS FOR INERTIAL CONFINEMENT FUSION

F. Winterberg
University of Nevada System, Reno, NV 89507
Journal Of Plasma Physics, Vol. 21, No. 2, pp 301-315 (04/1979).

A method of producing an intense heavy ion beam using a long drift tube is described. A beam entering the tube is compressed by varying the diode voltage and is contained by an axial magnetic field producing a high density pulse. A drift tube of 100 m can amplify a 10 GeV beam to a 100 TM beam using an accelerating voltage of 1 MV and a diode current on the order of 1 KA. Scaling up to even higher beam powers is discussed. 7 Refs.

Primary Keywords: Heavy Ion Beam; Drift Tube; Combining Magnetic Field; Space Charge Neutralized; Axial Beam Compression

COPYRIGHT: 1979 CAMBRIDGE UNIVERSITY PRESS

102
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

HIGH-VOLTAGE DC POWER CONDITIONER

D.L. Pruitt
PCA Corp., Morestown, NJ 08057
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1391-1393 (10/1979).

By adopting a variation of the series inverter circuit, liberally infused with artificial line-type pulse modulator technology, an effective, simple, and high performance technique has been devised. Low-frequency (50-400 Hz) transformers are eliminated by direct full-wave rectification of the AC power source. (With appropriate input filter design, power source frequencies from 50 to 400 Hz can be accommodated in one design.) A pair of suitable high-frequency thyristors alternately charge and discharge a pair of capacitors through the primary of the AC power transformer. Since the effective frequency is high (thousands of Hz), the transformer and load filter capacitor are small compared to those achieved at normal power frequency components. Operating Q is low (approaches one), minimizing the reactive power. Regulation of the output voltage is achieved by varying the pulse recurrence frequency: from as low as zero to some maximum (e.g. 20 kHz). No-load to full-load regulation < 0.5 percent has been demonstrated. The circuit is not harmed by overloads, and has a current fold-back feature. Normal operation resumes automatically when an overload is removed. 0 Refs.

Primary Keywords: DC Power Supply; Light Weight; Compact; High Efficiency; Thyristor Switched

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

103
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)

INDUCTIVE STORAGE PULSE-TRAIN GENERATOR

R.D. Ford and J.M. Vitkowsky
Naval Research Lab., Washington, DC 20375
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1527-1536 (10/1979).

Utilization of inductive storage in production of intense charged particle beams, laser beams, and hot dense plasmas of interest in thermonuclear fusion studies and in other research areas is very attractive because of its inherent compactness associated with energy storage in the form of magnetic fields. A major problem in utilizing inductive energy sources with sufficient output power for such beams and plasmas is the development of an opening switch. In some instances, repetitive pulse output is required, so that switches must open repeatedly at a frequency determined by the needs of the experiment. If only a small number of pulses is needed, then use of one switch per pulse in the train becomes a practical method for generating pulse trains with peak power determined by the performance of individual switches. Formation of pulse trains with peak pulse power in the range of 100 kEV to 1000 kEV was studied. This study included the investigation of single switch elements to determine methods for extending the operating power to higher levels. 5 Refs.

Primary Keywords: Explosive Fuse; Rep-rated; Burst Mode; Experiment, Theory

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

105
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

SHIELDED, HIGH-VOLTAGE PROBES

R.E. Bellinger (1) and D.L. Smith (2)
(1) State University of New York at Buffalo, Buffalo, NY 14226
(2) AFML, Kirtland AFB, NM 87117
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1553-1555 (10/1979).

A series of high-voltage probes (approximately 300 kV) with a high input impedance (>10 M Ω) and good frequency response (<10 MHz) have been built. These probes use two concentric cylinders of resistive material; the inner cylinder is the larger resistor of a voltage divider and the outer cylinder shields the inner one from the stray capacitance which would normally degrade the response. These cylinders can be made of almost any resistive material provided that certain theoretical considerations based on nonuniform field penetration and probe impedances are taken into account. The theories discussed are compared to the experimental results of several probes with different resistive materials and relative dimensions. Of primary interest are the probe's response, cost, weight, construction time, energy absorption, and system compatibility (loading and shielding). 5 Refs.

Primary Keywords: Resistive Voltage Dividers; High Input Impedance; Fast Rise Time; Concentric Conducting Cylinders; Stray Capacitance Shielding

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

109
(PARTICLE BEAMS, ELECTRON)
(Generation)

THE EXPERIMENTAL TEST ACCELERATOR (ETA)

R.E. Lester (1), D.G. Bube (1), J.C. Clark (1), A.W. Chesterman (1), E.O. Cook (1), H.L. Denton (1), T.J. Fassenden (1), L.L. Reginato (1), T.T. Yokote (1) and A.A. Faltinos (2)
(1) Lawrence Livermore Lab., Livermore, CA 94550
(2) Lawrence Berkeley Lab., Berkeley CA

IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 4180-4182 (06/1979).

The Lawrence Livermore Laboratory is constructing an induction linac with the following parameters: 10A, 50 ns, FWHM pulse width, 5 MeV, and 2.5 MeV injector and its associated pulsed power systems, 7 Refs.

Primary Keywords: ETA; LINAC; Design Considerations; Pulsed Power System; Rep-rated

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

114
(PARTICLE BEAMS, ION)
(Generation)

LINEAR INDUCTION ACCELERATORS MADE FROM PULSE-LINE CAVITIES WITH EXTERNAL PULSE INJECTION

Ian Smith
Ian Smith Inc., Alameda, CA 94501
The Review Of Scientific Instruments, Vol. 50, No. 6, pp 714-718 (06/1979).

Two types of linear induction accelerators have been reported previously. In one, unidirectional voltage pulses are generated outside the accelerator and injected into the accelerator cavity modules, which consist of ferromagnetic material which reduce energy losses in the form of currents induced in parallel with the beam in the cavity structure. In the other type, the accelerator cavity modules are themselves pulse-forming lines with energy storage and switches; parallel current losses are made zero by the use of circuits that generate bidirectional acceleration waveforms with a zero voltage-time integral. In a third type of design described here, the cavities are externally driven, and 100% efficient coupling of energy to the beam is obtained by designing the external pulse generators to produce bidirectional voltage waveforms with zero voltage-time integral. A design for such a pulse generator is described that is itself one hundred percent efficient and which is well suited to existing pulse power techniques. Two accelerator cavity designs are described that can couple the pulse from such a generator to the beam; one of these designs provides voltage doubling. Comparison is made between the accelerating gradients that can be obtained with this and the preceding types of induction accelerator. 10 Refs.

Primary Keywords: Linear Induction Accelerator; 100 Percent Efficient Energy Coupling; Bidirectional Accelerating Pulse; Accelerator Cavity

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

118
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)

MAGNETOOPTICAL CURRENT TRANSFORMER. I: PRINCIPLES

A. Papp and H. Herms
Siemens AG, Munich, FRG
Applied Optics, Vol. 19, No. 22 pp. 3729-3734 (11/1980).

The authors present a method of measuring current in a high voltage line using a magnetooptical transformer. The use of optical fibers as transmission lines and current sensors, and the birefringence problems that result are discussed. 20 Refs.

Primary Keywords: Magnetooptical Current Transformer; Principles

COPYRIGHT: 1980 OPTICAL SOCIETY OF AMERICA

119
(PARTICLE BEAMS, ELECTRON)
(Generation)

UPGRADING THE AURORA SIMULATOR

A.G. Stewart
Harry Diamond Labs., Adelphi, MD 20783
Harry Diamond Lab. Report No. HDL-TR-80-28 (10/1980).

Availability: AD-A092501 NTIS

The necessary degree of control was acquired over those machine parameters that determine the bremsstrahlung dose output of the simulator, thereby improving the simulator efficiency and extending its range of applications. At a given charge voltage on the Marx generator, average dose output at the center of the test volume (TCV) was increased by approximately 20 percent; the peak dose output exceeded 50 krad (TCV) for the first time, and reproducible low dose (50 rad) at low beam energy (4 MeV) was established. One result of these improvements is that overall machine maintenance time has been reduced. 0 Refs.

Primary Keywords: AURORA; Pulsed Power; High Intensity Bremsstrahlung Production

123
(PULSE GENERATORS: PARTICLE BEAMS, ELECTRON)

(Systems; Generation)

OPERATION OF A 300-KV, 100-MHz, 30-KW AVERAGE POWER PULSER

M.T. Buttram and G.J. Rohrman
Sandia Labs., Albuquerque, NM 87115

IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1503-1508 (10/1979).

Applications for efficient and reliable pulse power systems with long lifetimes (>100 shots) are forced for electron-beam generators, ion-beam accelerators, and lasers leading eventually to inertial confinement fusion reactors. These systems will have to be capable of continuous operation or sustained periods without requiring major maintenance or repair. High-operations efficiency will be required not only to minimize power consumption but also to avoid heat buildup and consequent damage to components. The system described in this paper represents an initial effort to develop an efficient energy-handling high-voltage pulser to study the problems of long-life components. 5 Refs.

Primary Keywords: Pulse Transformer; Pulse Forming Line; Output Switch; Charging Circuit; Rep-rated; Long Lifetime

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

124
(SWITCHES, CLOSING)

(Ignitrons)

ORIENTATION INDEPENDENT IGNITRON

R.J. Harvey and J.R. Bayless
Hughes Research Labs., Culver, CA 90265

2nd IEEE International Pulsed Power Conference Proceedings, pp 372-375 (06/1979).

An orientation independent igniton (OI) has been operated at 30 kV, 15 mA with 10 microsecond wide pulses at frequencies up to 100 Hz. The cathode of the OI is a thin mercury film which is held in place by surface tension on a cooled molybdenum substrate. This device has been shown to have a basic voltage withstand of over 60 kV, trigger characteristics comparable to conventional ignitrons, a current rate of rise in excess of 10 kA/microsecond at 30 kV, and a mean stable run time at 8 A average current of 22 s in the burst mode. Reformation of the film occurs during and following the pulse burst with a recycle time on the order of 10 min. 0 Refs.

Primary Keywords: Orientation Independent; Rep-rated; Mercury Film; Surface Tension

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

**127
(PULSE GENERATORS)
(Systems)**

POWER SYSTEM FOR A HIGH-POWER BURST MODE PULSED LOAD

T.W. Robinson
GEC Marconi Research Labs, Essex, UK
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1394-1400 (10/1979).

A novel power system, recently completed and commissioned, is described. Operating directly from an 11-kV, 50-Hz public supply, it provides the electrical energy for a burst mode, pulsed load. In each burst, the minimum energy delivered by the system is about 100 kJ at a rate of 330 kW. The pulse modulator operates at a peak charge of 105 kV and is capable of switching 200 MW over a range of pulse lengths and repetition rates. The high-voltage, high-current thyratrons used as the charge, discharge, and PFN energy dump switches were specially developed four-gap CX 11998 thyratrons. Supply voltage stepup transformers were designed to operate over bursts of variable pulse number, length, and rate, with the rectified unfiltered transformer output directly feeding the modulator charging circuit, up to 65 kV. Polarizing effects in the transformer core caused by the use of repetition rates equal to, or harmonically related to, the supply frequency were analyzed and effectively eliminated. Special winding techniques were developed to provide the strength and insulation required for transients. 3 Refs.

Primary Keywords: Power Line Operation; High Energy; Rep-rated; Pulse Forming Network; Direct Load Coupling

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

**140
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)**

HIGH DENSITY Z-PINCH PULSE POWER SUPPLY

W.C. Munnally, C.A. Ekdahl, J.E. Hammel, K.W. Henks and L.A. Jones
Los Alamos National Labs, Los Alamos, NM 87545

1978 IEEE Thirteenth Modulator Symposium, pp 289-292 (06/1978).
The pulse-power supply for the High Density Z-pinch (HDZP) experiment at LASL, described in this paper, is required to produce a peak voltage on the order of 1 MV and a peak current of 1 MA in a small, high-pressure gas load. The experimental load is a small diameter (100 micrometers) current filament between two electrodes spaced 10 cm apart with a 20-cm diameter coaxial return conductor. The current filament is to be initiated with an 18-J, 18-ns, Q-switched Nd:glass laser. The HDZP system consists of a 75-nH, 600-kV, 72-kJ Marx bank that resonantly charges a water-insulated intermediate storage line. A prototype of 1/12 of the system is also described. The prototype has been tested at its design values. The large system is to become operational in November 1978. 1 Refs.

Primary Keywords: Marx Generator; Pulse Forming Line; High Voltage

Secondary Keywords: Z-pinch

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**143
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE)
(Rotating Machines; Systems)**

MG ENERGY STORAGE AND SWITCHED PULSE POWER SUPPLY

K.I. Selin
The JET Project, Abingdon, Oxfordshire, UK

1978 IEEE Thirteenth Modulator Symposium, pp 293-296 (06/1978).
For the JET (Joint European Torus) device there are four main pulse power supplies for the following loads: (a) the poloidal field circuit (b) the toroidal field magnetets (c) the plasma positioning (d) the plasma additional heating. The (a) supply will be described in this paper. It is presently in the design stage at GEC Machines Limited, U.K. and is scheduled for operation in 1982. A motor-generator with integrated rotor and flywheel will be used in a pulsed mode. The time between load pulses (9 minutes) is used for acceleration of the flywheel-generator. The generator output AC is rectified in a diode converter. The nominal energy extracted from the flywheel-generator-converter (FGC) is 2600 MJ at a maximum rate of 400 MW. A magnetic energy storage is included in order to reach a still larger load power. 2 Refs.

Primary Keywords: Motor-generator; Power Modulation; Design

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**144
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Systems; Capacitor Banks)**

NEUTRINO BEAM OF THE INSTITUTE OF HIGH-ENERGY PHYSICS. V. PULSED POWER SUPPLY FOR THE NEUTRINO FOCUSING SYSTEM

D.G. Baratov, N.Z. Bikbulatov, V.V. Vasil'ev, E.V. Eremenko, S.A. Knyazev, Yu.A. Lastochkin, V.P. Oschepkov, V.L. Rykov, A.V. Semoilov, K.Z. Tushabramishvili and A.V. Chernov
Institute Of High-Energy Physics, Protvino, USSR
Soviet Technical Physics, Vol. 23, No. 1, pp 53-57 (01/1978).

Trans. From Zhurnal Tekhnicheskikh Nauk, Vol. 48, No. 91-92 (January 1978).
The 350-kJ system that produces unipolar current pulses of 500 kA with length approximately 150 microseconds in the three objective lenses of the neutrino focusing system is described. The system consists of 12 capacitor-bank modules. The modules are connected in parallel with the loads by small ignitrons. The loads are cable transformers whose secondary circuits include the objective lenses of the neutrino focusing system. Schematic diagrams are given for the pulse current generator, the control system, and the monitor system. The basic capabilities of the system are described. 10 Refs.

Primary Keywords: Current Generator; Ignitron; Capacitor Banks; Pulse Transformer; 500 KA Current; 150 Microsecond Pulse Duration

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**153
(PARTICLE BEAMS, ION)**

(Generation)

QUASI-STATIC DRIFT-TUBE ACCELERATING STRUCTURES FOR LOW-SPEED HEAVY IONS

A. Faltens and D. Keefe
Lawrence Berkeley Lab, Berkeley CA

Particle Accelerators, Vol. 8, pp 245-253 (01/1978).

Pulsed drift tubes are discussed as a possible method of accelerating high current bunches at low energies. Several setups for voltage sources and waveforms which could be used to generate the 1 MV pulses to drive the drift tubes are discussed. Pulse shaping and the drift tube structure are also considered. 9 Refs.

Primary Keywords: Drift-tube; Accelerator; Pulse Shaping; Drift-tube Systems

COPYRIGHT: 1978 GORDON AND BREACH. SCIENCE PUBLISHERS LTD.

**161
(ENERGY CONVERSION, THERMAL)
(Loads)**

LOADS FOR HIGH-POWER TESTING

B.R. Gray
Rome Air Development Center

1978 IEEE Thirteenth Modulator Symposium, pp 70 (06/1978).
The designer or test engineer of high-power systems is often faced with the problem of substituting a load for some portion of the system for the purpose of evaluating some other components in the system, trouble shooting, checkout of the system, calibration, or for system optimization. To be truly equivalent load it must match the normal load in its reactive and resistive power relationship, its voltage/current ratio as a function of time, power-absorbing ability, polarity, and many other factors. A test load may be required anywhere between the prime power source and the final output. It could mean a load bank on a large AC or DC power line or a transformer/recifier/rectifier type load in the power conditioner stage of the system, or the entire output of the total system. An example of some substitute loads discussed would be an rf load on the output of an rf amplifier, beam energy absorbers in accelerators, pulsed power load at the video level, and equivalent diode loads for modulators, etc. 0 Refs.

Primary Keywords: Design Considerations

Secondary Keywords: Abstract Only

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**162
(PULSE GENERATORS)
(Reviews)**

PULSED POWER FOR EMP SIMULATORS

I.D. Smith and H. Aslin
Physic International Co, San Leandro, CA 94577

IEEE Transactions On Antennas And Propagation, Vol. AP-26, No. 1, pp 53-59 (01/1978).

Simulation of nuclear weapons effects has been the main motivation for pulse power development in the U.S. in the last decade. EMP simulation has been responsible for a major class of pulse power systems. A general survey of pulse power techniques is given, focusing on those particularly applicable for EMP simulation. This is followed by brief description of several representative simulators. 12 Refs.

Primary Keywords: Marx Generator; L-C Generator; Stacked Line Generator; Insulation; Switching; EMP Simulation

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**164
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Spiral)**

SIMPLE, PULSED, ELECTRON BEAM GUN

C.A. Brau (1), J.L. Raybun (1), J.B. Dodge (2) and F.M. Gilman (2)

(1) Los Alamos National Labs, Los Alamos, NM 87545

(2) Avco Everett Research Lab, Inc, Everett, MA 02149

Review Of Scientific Instruments, Vol. 48, No. 9 pp. 1154-1160 (04/1977).

The construction of a simple, inexpensive electron beam gun is described. The pulsed power supply consists of a homemade spiral generator, constructed with aluminum and vinyl pressure-sensitive tapes, which is switched onto the electron gun with a spark gap. The electron beam gun itself consists of a vacuum diode with a cold carbon cathode. From an initial charge voltage of 12 kV, the apparatus produces a 10-A beam of 100-keV electrons having a pulse duration of about 7 nsec and diameter of 6 mm. 6 Refs.

Primary Keywords: E-Beam Gun; Spiral Generator; Vacuum Diode

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**166
(POWER CONDITIONING)
(Pulse Transformers)**

THE 10 MILLISECOND 150 KILOAMPERE PULSED POWER SUPPLY FOR THE FERMILAB NEUTRINO FOCUSING HORN

R.C. Tressler
Fermi National Accelerator Lab, Batavia, IL 60510

IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 3977-3979 (06/1979).

In order to provide the long spill (one millisecond) necessary for simultaneous operation of the 15-Foot Bubble Chamber Neutrino experiments and counter experiments, the existing short pulse (20 microseconds) Neutrino Focusing Horn power supply was extensively modified. A large high current (200 kiloamp) pulse transformer was procured and installed to modify the circuit impedances. The changing of the electrical characteristics of the system, protection systems, and installation of the transformer will be discussed. 4 Refs.

Primary Keywords: Pulse Transformer; Long Pulse; Sinusoidal Pulse; Capacitor Bank; Ignitron; System Protection

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

**174
(POWER TRANSMISSION)
(Transmission Lines)**

SPACE-CHARGE EFFECTS IN LONG COAXIAL VACUUM TRANSMISSION LINES

J.W. Poukey and K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115

Applied Physics Letters, Vol. 32, No. 1, pp 8-10 (01/1973).

A new two-dimensional time-dependent electromagnetic particle code is applied to the high-voltage pulsed power flow problem in a long self-magnetically insulated coaxial line. It is found that the current leakage occurs only near the front of the voltage pulse, that energy transport is very efficient at high voltages, and that the electrons in the insulated region do not get close to the anode. 11 Refs.

Primary Keywords: Transmission Line; Magnetic Insulation; Power Flow Simulation; Numerical Calculation; 2-d Particle Code

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

178
(DIAGNOSTICS AND INSTRUMENTATION; ENERGY CONVERSION, ELECTRICAL)
(Systems; Power Supplies)
A FACILITY FOR TESTING HIGH POWER DC, AC, OR PULSED DEVICES
R.N. Miller, P.T. Glinski and A.S. Gilmore Jr.
State University of New York at Buffalo, Buffalo, NY 14226
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-7 (11/1976).
A pulsed power test facility being developed for the high power testing of pulsed power and power devices is described. A bank of lead-acid batteries provides the facility with a power source having a maximum discharge capacity of 1,889 joules; the battery can be switched into various series-parallel configurations to realize voltage-current combinations up to 10 kV at 250 A. The battery bank output terminals can be turned on and off at the test bench with a vacuum arc switch if desired. A high vacuum pumping station is built into the test bench for those devices requiring evacuation. An inverter using vacuum arc switches is being developed to convert the power to a sinusoidal AC source having a suitable frequency of up to 10 kHz. The battery bank operation is monitored and controlled either manually or by a microprocessor-based instrumentation system. The instrumentation system automates the battery charging cycle and shuts off the system whenever hazardous conditions develop in the facility during either the charge or the discharge cycle. Among the applications being investigated for the facility are the pulse and duration testing of vacuum arc switches and the development of a high-power inverter. 7 Refs.
Primary Keywords: Pulsed Power Test Facility; Battery; Very High Energy; Medium Voltage; Microprocessor-based Instrumentation.

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

179
(SWITCHES, OPENING)
(Explosive Fuses)
A METHOD FOR ENHANCING EXPLoding ALUMINUM FOIL FUSES FOR INDUCTIVE STORAGE SWITCHING
D. Conte, M. Friedman and M. Ury
Naval Research Lab., Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-7 (11/1976).
The success of inductive storage systems is dependent on the development of fast, low loss opening switches. An approach to this problem is to stage several successively faster switches such as circuit breakers and fuses, in a manner so as to minimize overall losses while achieving an effective fast opening time. In this paper, we discuss the properties of an aluminum foil fuse immersed in water or hydrogen peroxide for use as one of the final fast acting elements. Although it has been shown that the time to explosion is dependent on the fuse material, peak current amplitude, and rise time, we speculate that the opening characteristics are also influenced by chemical reactions and heat transfer with the surrounding medium. Data is presented showing that the final resistivity can be optimized by proper foil dimensions and further increased by the use of chemically more active surrounding medium such as hydrogen peroxide. 6 Refs.
Primary Keywords: Inductive Energy Storage; Exploding Fuse; Low Loss; Hydrogen Peroxide Medium.

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

180
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)
HIGH VOLTAGE SWITCH PERFORMANCE OF THE EIMAC X-2159 TETRODE
B.R. Gray
RADC, Griffiss AFB, NY 13440
1976 IEEE Pulsed Power Conference Proceedings, Paper IC-4 (11/1976).
High Power Tetrodes designed as RF power amplifiers often times have excellent characteristics that enhance their performance when used as switch tubes. This paper reports on the test and evaluation of one such high power tetrode, the EIMAC X-2159. This tube has a design anode dissipation rating of 1.25 megawatts average power and the cathode grid and screen have very substantial ratings. The objective of the test was to determine the maximum achievable pulsed power with this tube. One main data point of interest was a pulsed current of 1000 amperes-10⁻² microseconds and 50 KV hold-off. This point has been achieved. Further testing is planned to fully evolve the limits. Problems encountered included secondary emission causing the load pulse to increase in length as if it were a function of primary emission from grid. Other features of the tube to be discussed will be the ability to interrupt a faulted load current pulse and its overall operating stability. 0 Refs.
Primary Keywords: EIMAC X-2159 Tube; Operational Parameters; Test Results.

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

182
(PULSE GENERATORS)
(Systems)
MAGNETIC FIELD CALCULATIONS FOR HIGH-ENERGY PULSED POWER SUPPLIES
E.B. Becker, M.D. Driga, R.D. Pillbury, H.G. Rylander, W.F. Weldon and
W.H. Woodson
University of Texas at Austin, Austin, TX 78712
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-2 (11/1976).
An accurate calculation of the magnetic fields, steady or rapidly varying, is extremely important in designing pulsed power supplies for controlled thermonuclear fusion experiments, lasers, etc. where the traditional simplifying assumptions become unacceptable - especially when ferromagnetic materials in high magnetic fields are used. A finite element method for solution of Maxwell's equations for a moving media in terms of the magnetic vector potential and electrokinetic scalar potential describing the penetration of the magnetic fields in fast pulsing power supplies of electromechanical type is presented. The formulation for the steady-state magnetic fields in nonlinear media results as a particular case of the method. This approach was used for predicting the discharge parameters for the very fast discharging homopolar machine (FDPM) designed by the Energy Storage Group at the University of Texas. FDPM is an advanced state of execution. This work was supported by the Electric Power Research Institute (EPRI) and the Energy Research and Development Administration (ERDA). 6 Refs.
Primary Keywords: Magnetic Field Calculation; Steady State; Pulsed; High Fields; Numerical Calculation; Finite Element

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

184
(ENERGY STORAGE, INDUCTIVE)
(Review)

PULSE POWER SYSTEMS EMPLOYING INDUCTIVE ENERGY STORAGE
T.F. Trost, P.E. Morrison and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-1 (11/1976).
Basic circuits for utilizing inductive energy storage in high-power pulsers are compared in order to judge overall system performance. The comparisons are made from the standpoint of the power requirements and efficiencies for inductor charging and the switching times and efficiencies for discharging into the load. The response of several circuits are calculated, and the trade-offs in performance are discussed. 5 Refs.
Primary Keywords: Inductive Energy Storage; Performance Comparison; Design Considerations.

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

186
(ENERGY STORAGE, INDUCTIVE)
(Systems)

SUPERCONDUCTIVE INDUCTOR STORAGE AND CONVERTERS FOR PULSED POWER LOADS
N. Mihaylo (1) and H.A. Peterson (2)
(1) University of Minnesota, Minneapolis, MN
(2) University of Wisconsin, Madison, WI
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-6 (11/1976).
There is a foreseeable need for supplying repetitively pulsed power loads of large magnitudes, with peaks of hundreds of megawatts or more. The nature of such loads can be expected to be as diverse as their application and the pulse durations may range from less than a microsecond to many seconds or minutes. In this paper, loads with pulse durations greater than several milliseconds are considered. The pulsed power demand and corresponding volt-ampere requirement are undesirable from the frequency and voltage fluctuation standpoint, even for the largest utility power systems. Superconducting pulsed energy magnitude superconductive inductor storage may be an economic cell employed to reduce the power pulses on the utility system. In this paper, several schemes of interconnecting the pulsed load and the storage inductor are compared in terms of the pulsed power and reactive volt-ampere requirements imposed on the power system. The effects of the storage inductor capacity and the power ratings of the interface converters are explored. A partial or complete elimination of pulsed power and reactive volt-ampere demands on the power system are possible through proper design. 3 Refs.
Primary Keywords: Inductive Energy Storage; Long Pulses; Re-rated; Inductive Load.

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

187
(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
(Systems; Flux Compression)

TERAWATT PULSE POWER SYSTEMS UTILIZING INDUCTIVE STORAGE
E.C. Chare, M. Cowan, H.K. Tucker, W.B. Leisher and D.L. Wiesberg
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-4 (11/1976).
This paper describes a system which employs a superconducting magnet, a generator coil, and nondestructive magnetic flux compression to produce pulsed power. Power in the terawatt range is predicted for full-scale systems suitable for both laser and e-beam applications of the future. Small-scale experiments are described which employed radially expanding aluminum tubes or plasma to produce peak powers of 0.5 gigawatt. 7 Refs.
Primary Keywords: Superconducting Magnet; Magnetic Flux Compression; Generator; Nondestructive; Pulsar

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

188
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, MECHANICAL)
(Systems; Rotating Machines)

THE NRL MULTI-MEGAJOULE INERTIAL-INDUCTIVE ENERGY STORAGE SYSTEM
W.H. Lupton, A.E. Rebson and W.L. Warnick
Naval Research Lab., Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-3 (11/1976).
In the NRL multi-megajoule pulse power system, energy is transferred from inertial storage (flywheels) to inductive storage by a self-excited homopolar generator. Reliable operation of the inertial storage at 5 MJ per flywheel is obtained from recent improvements in flywheel mounting, bearing lubrication, cooling and hydrodynamic power systems. This approach to energy conversion is only possible by use of copper-to-carbon fiber brushes which can follow rapid variations in wheel radius. Experimental efforts are being devoted to reducing the presently high frictional wear of these brushes. 3 Refs.
Primary Keywords: Inertial Energy Storage; Inductive Energy Storage; Multi-megajoule; Copper and Graphite Fiber Brushes

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

189
(POWER TRANSMISSION)

(Transmission Lines)

VLINE: AN EFFICIENT ALGORITHM FOR MODELING VARIABLE IMPEDANCE TRANSMISSION LINES

C.M. Jones Jr.
Pulsar Associates Inc., San Diego, CA 92121
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-8 (11/1976).
Transmission lines with a variable impedance are the most practical means for performing impedance transformation in large pulsed power machines. An effective and practical calculation technique is required which can provide adequate modeling of expected machine performance as part of engineering design analysis. An efficient algorithm has been developed for modeling a transmission line characterized by an impedance which varies in an arbitrary but continuous function over the length of the line. A FORTRAN subroutine incorporating the algorithm is discussed. Comparisons of the algorithm results with the analytic solutions by Schatz and Williams for the special case of the exponential tapered line are shown. The algorithm employs transmission and reflection coefficients that realistically model the response of the line to the high frequencies which are especially of interest in pulsed power work. The traditional approximation of considering such a line to be a series of short segments of constant impedance implicitly ignores the high frequencies and converges more slowly as a result. 1 Refs.
Primary Keywords: Variable Impedance; Impedance Transformation; Modeling; Analysis; Computer Simulation

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

- 191
 (ENERGY STORAGE; MECHANICAL)
 (Rotating Machines)
APPLYING A HOMOPOLAR POWER SUPPLY TO A TOKAMAK
 P. Wildi, S. Hutchins and M. Driga
 University of Texas at Austin, Austin, TX 78712
 1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-5 (11/1976).
 The new Tawas Experimental Tokamak will use homopolar generators as a pulsed power source. The high current, low voltage output of such a source calls for unusual solutions to achieve a proper match to toroidal coil system and ohmic heating system. The paper discusses several possible alternatives. The solutions chosen for both the toroidal and the heating coil system are described including some of the salient components such as switches and power electronics. 3 Refs.
 Primary Keywords: Homopolar Generator; Application: Impedance Matching
 Secondary Keywords: Tokamak; Toroidal Field Coil
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 194
 (ENERGY STORAGE; CAPACITIVE; PULSE GENERATORS)
 (Capacitor Banks; Capacitor Banks)
MODULAR FAST CAPACITOR BANK FINAL REPORT
 P.D.A. Chapman
 Physics International Co., San Leandro, CA 94577
 AFML Report No. AFML-TR-74-132 (04/1975).
 Availability: AD-A010342
 NTIS
 The report describes the development of a fast capacitor bank module storing 55 kJ at 100 KV DC, capable of operation by itself or as part of a larger system. The module is gasketed and utilizes two triggered gaseous dielectric rail switches operable over the voltage range 15 to 50 KV DC. The module inductance is 8 nH. 10 Refs.
 Primary Keywords: Energy Storage; Capacitor Bank; Low Inductance Switches; Rail Gap
- 196
 (PARTICLE BEAMS, ELECTRON)
 (Systems)
INITIAL PROTO II PULSED POWER TESTS
 D.L. Johnson
 Sandia Labs, Albuquerque, NM 87115
 1976 IEEE Pulsed Power Conference Proceedings, Paper IE-2 (11/1976).
 The Proto II electron beam accelerator is being developed by Sandia Laboratories to study engineering and physics aspects of electron beam pellet fusion. Currently the Marx generator-water capacitor portion of Proto II is undergoing high voltage testing and timing measurements. Eight 112 kV Marx generators form the primary energy storage system. Each Marx generator pulse charges two parallel 7.5 nF water capacitors to 3 MV. The water capacitors act as intermediate energy storage elements and will transfer their energy to the water insulated pulse-forming lines in 250 ns by means of eight 500 μ F/67 μ s insulated, trigatron switches. Test data and design considerations of the trigger systems, Marx generators, water capacitors, and trigatron switches will be presented. 5 Refs.
 Primary Keywords: Proto II; E-beam; Marx Generator; Pulse Shaping; Test Data; Design Considerations
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 198
 (PARTICLE BEAMS, ION; INSULATION, MAGNETIC)
 (Generation)
MAGNETICALLY INSULATED PULSE POWER DRIVEN LINAC
 F. Winterberg
 University of Nevada System, Reno, NV 89507
 1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-7 (11/1976).
 It is shown that a linear accelerator of modest dimensions using magnetically insulated accelerating components can be driven by electric pulsed power sources to accelerate ion beams of heavy ions to multi-Gev energies. The most important application of such an accelerator would be for the ignition of thermonuclear microexplosions but it could also ideally serve as a research tool for heavy ion induced nuclear reactions. 10 Refs.
 Primary Keywords: Linac; Magnetic Insulation; Heavy Ion Beam; Microexplosives; Very High Energy
 Secondary Keywords: Thermonuclear Microexplosion
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 199
 (SWITCHES, CLOSING)
 (Thyristors)
NEW OPTIONS IN PULSE POWER UTILIZING LASS SWITCHES
 O. Zucker
 Lawrence Livermore Lab, Livermore, CA 94550
 1976 IEEE Pulsed Power Conference Proceedings, Paper IB-6 (11/1976).
 Light Activated Silicon Switches are high power, fast rise time, semiconductor devices which open new possibilities in the pulse field. Specifically, the distributed nature of the current path and the sub nanosecond rise time of these devices enables 0 Refs.
 Primary Keywords: Light Activated Silicon Switches; Fast Rise Time; Re-rate
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 201
 (ENERGY STORAGE, MECHANICAL)
 (Rotating Machines)
PULSED POWER FROM INERTIAL STORAGE WITH HOMOPOLAR MACHINES FOR CONVERSION
 M.M. Woodson, M.G. Rylander and J.F. Walton
 University of Texas at Austin, Austin, TX 78712
 1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-1 (11/1976).
 Because of its simplicity, an inertial energy storage with a homopolar machine for conversion can provide a relatively inexpensive pulsed-power supply for some important applications. The fundamental principles of operation of homopolar machines are given along with configurations that have been used or proposed and scaling laws for each configuration. Operating characteristics and costs are described as functions of energy level, discharge time and voltage level. The physical limitations on system performance are described to define the ranges of applicability of the concept. 4 Refs.
 Primary Keywords: Homopolar Generator; Operating Characteristics; Limitations
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 204
 (ELECTROMAGNETIC COMPATIBILITY)
 (Grounding And Shielding)
SAVING DIAGNOSTICS IN THE PULSE-POWER ENVIRONMENT
 R.A. Fitch
 Maxwell Labs Inc, San Diego, CA 92123
 1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-5 (11/1976).
 Contorted oscillograms and outraged equipment are a commonplace of pulse-power systems. This paper attempts to explain why and what to do about it. 0 Refs.
 Primary Keywords: Shielding; Noise Suppression; Short Pulse Operation; Noise Coupling
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 205
 (REVIEWS AND CONFERENCES)
 (Reviews)
THE EVOLUTION OF PULSED POWER
 G.K. Simcox, J.J. Moriarty and T.J. Griffin
 Raytheon Co, Bedford, MA 01730
 1976 IEEE Pulsed Power Conference Proceedings, Paper III-E-1 (11/1976).
 A review of pulse power developments is presented from the viewpoint of low duty-cycle, high power, high voltage generator technology. The effects of increasing duty-cycle upon dielectrics, switching, generator form and engineering problems are briefly discussed. Recognizing the importance of power conditioning and prime power management, the limitations and fundamental importance of pulsed power techniques are explored with reference to the Con-rolled Thermonuclear Reaction field. 4 Refs.
 Primary Keywords: Pulsed Power Development; Nonrep-rated; Power Conditioning; Rep-rated; Limitations
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 206
 (PULSE GENERATORS)
 (Miscellaneous)
THE PLASMA FOCUS AS A PULSED POWER SOURCE FOR DRIVING FU' MICROEXPLOSIONS
 H.L. Sahlin
 Lawrence Livermore Lab, Livermore, CA 94550
 1976 IEEE Pulsed Power Conference Proceedings, Paper III-E-6 (11/1976).
 The plasma focus is a very remarkable device. Careful study of this phenomenon reveals that nature has provided a means of time energy compression superior to most if not all inventions in this field. The focus provides a means of converting relatively slow capacitive energy storage into energy of a rapidly imploding plasma shell and high density inductive stored energy behind this plasma shell. The focus then acts as its own switch by suddenly changing the r^2 pinch resistivity by a factor that can exceed 100, and as a result inductive energy is converted into heating of the dense plasma which now acts as target. The mode of energy concentration of the burn into its own self switching pinch provides a natural mode of burn that may be more effective than the various means that have been proposed for driving a D-microexplosion. We will review the efforts at Livermore to drive fusion microexplosion with the plasma focus utilized as a self-switched pulse power source. The physical phenomenon involved in interrupting the current will be re-strike of the current either as a relativistic electron burst or as short duration ion burst, depending on the operating conditions, will be treated in detail. The relation of our work at LL to similar efforts in the Soviet Union will be presented, and the similarity to the plasma focus to the current collapse observed in low impedance relativistic e-beam diodes will be explored. 0 Refs.
 Primary Keywords: Dense Plasma Focus; Pulse Compression; Opening Switch
 Secondary Keywords: Fusion Driver
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 208
 (PULSE GENERATORS)
 (Electrostatic)
VARIABLE CAPACITANCE ELECTROSTATIC ELECTRICAL PULSE GENERATOR
 O.P. Breux
 Air Force Avionics Lab, Wright-Patterson Air Force Base, OH 45433
 1976 IEEE Pulsed Power Conference Proceedings, Paper III-E-8 (11/1976).
 Variable capacitance electrostatic generators are capable of rugged efficient operation and high power output. An exposition is given of a variable capacitance electrostatic energy conversion system, employing self-contained excitation, for electrical pulsed power generation, including mathematical analysis and comment on practical realization. 10 Refs.
 Primary Keywords: Electrostatic Pulse Generator; Variable Capacitance; High Efficiency; High Power; Analysis
 COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION
- 215
 (ENERGY STORAGE, INDUCTIVE)
 (Systems)
DESIGN AND CONSTRUCTION OF AN INDUCTIVE STORAGE UNIT FOR LASER PUMPING
 I.I. Artemonov, B.A. Barikhin, V.V. Borovikov and V.I. Keshintsov
 Sov. J. Quantum Electron., Vol. 9, No. 1 pp 70-73 (01/1979).
 Trans. by Kvantovaya Elektron. (Moscow) 6:127-133 (January 1979)
 Analytic expressions are presented for an exploding wire switched inductive energy storage system model is derived for the case of complex impedance loads (inductance and capacitance) and results are compared to an experiment utilizing a flesh lamp as a complex impedance load. Power into the load is seen to be increased over that delivered by capacitance energy storage. 9 Refs.
 Primary Keywords: Inductive Storage; Exploding Wire; Complex Loads; Theory; Experiment
 Secondary Keywords: Laser Pumping; Flesh Lamps; Circular Spark Gap
 COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS
- 217
 (SWITCHES, CLOSING)
 (Thyatron)
HIGH FREQUENCY THYRATRON EVALUATION
 G.A. Hill (1) and T.R. Burkes (2)
 (1) BDM Corporation
 (2) Texas Tech University, Lubbock, TX 79409
 2nd IEEE International Pulsed Power Conference Proceedings, pp 364-367 (06/1979)
 The high frequency characteristics of a triple grid thyatron are investigated. The pentode thyatron has three closely spaced grids and operates much like a conventional tetrode thyatron. The first grid has a dual function: it functions as a focusing grid, polarizing the grid-cathode space, as well as a shield grid, isolating the control grid from the cathode plasma during the recovery phase. The second grid is the control grid, with negative control characteristics. The third grid is a shield grid, designed to enhance the control grid aperture deionization. This thyatron is tested in a line-type pulser to determine its high frequency limitations. It proves capable of operating at pulse repetition frequencies of up to 180 kHz. 2 Refs.
 Primary Keywords: Pentode Thyatron; Focusing Grid; Control Grid; Thyatron; Line-type Pulser; Fast Rise
 COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

219
(SWITCHES, CLOSING)
(Thytrons)

HOLLOW-ANODE MULTIGAP THYRATRONS

H. Monown and C.V. Hobbs
English Electric Valve Co Ltd, Chelmsford, Essex, UK
2nd IEEE International Pulsed Power Conference Proceedings, pp 363-366 (06/1979).

Subsequent to the introduction of single-gap, hollow-anode tubes in 1978, a new range of multigap hollow-anode tubes is being introduced. There are many applications where high rates of rise of inverse voltage cause premature failure of conventional multigap thytrons due to arc-back. One solution has been to use double-cathode tubes, which are capable of reverse conduction without deterioration of performance. The hollow-anode tubes offer the similar advantage of tolerating reverse conduction without requiring extra high-voltage-isolated supplies. The operation of these tubes in low-inductance circuits is compared with conventional solid-anode tubes. 2 Refs.

Primary Keywords: Arc-back; Comparison With Solid Anode Tube

Secondary Keywords: Abstract Only

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

221
(ELECTROMAGNETIC LAUNCHERS)
(Reviews)

ELECTROMAGNETIC GUNS, LAUNCHERS AND REACTION ENGINES

W. Kolm, K. Fine, F. Williams and P. Mongeon
Massachusetts Institute of Technology, Cambridge, MA
2nd IEEE International Pulsed Power Conference Proceedings, pp 42-48 (06/1979).

Recent advances in energy storage, switching and magnet technology make electromagnetic acceleration a viable alternative to chemical propulsion for certain tasks, and a means to perform other tasks not previously feasible. Launchers of interest include the DC railgun driven by energy stored initially in a homopolar generator and transferred through a switching inductor, and the opposite extreme—the synchronous mass driver energized by a high voltage alternator through an oscillating coil-capacitor circuit. A number of hybrid vehicles, such as railguns, are also promising. All of these systems, developed here in the momentum transducer which transfers momentum from a massive chemically driven armature to a much lighter, higher velocity projectile by magnetic flux compression. Potential applications include the acceleration of gram-size particles for hypervelocity research and for use as reaction engines in space transport; high velocity artillery; stretcher-size tactical supply and medical evacuation vehicles; the launching of space cargo or nuclear waste in one-ton packets using off-peak electric power. 21 Refs.

Primary Keywords: Electromagnetic Propulsion; Railgun; Synchronous Mass Driver; Flux Compression Generator; Superconducting

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

223
(SWITCHES, CLOSING)
(Thytrons)

NEW HYDROGEN THYRATRONS FOR ADVANCED HIGH POWER SWITCHING

D. Turnquist (1), R. Ceristi (1), S. Friedman (1), S. Merz (1), R. Planté (1) and H. Reinhardt (2)
(1) EG&G Inc., Salem, MA 01970
(2) Consultant, Lexington, MA
2nd IEEE International Pulsed Power Conference Proceedings, pp 17-24 (06/1979).

Recent advances in high power switching have led to the development of new hydrogen thytrons operating at high $\text{d}I/\text{dt}$ and high $\text{d}V/\text{dt}$ with low jitter and long life. Short commutation times, dependent on internal pressure and geometry, and on the method of triggering, combine with inductance less than $1/4 \mu\text{H}/\text{V}$ to give $\text{d}I/\text{dt}$ on the order of 10^{12} amperes per second. Experimental results are in agreement with those predicted by newly derived theoretical models. Operation at peak currents up to 75 kA has been achieved for 10 microsecond pulses, and much higher currents can be obtained with shorter pulse widths. Tests at 1 MW of average power have verified thytron scaling laws at tens of amperes average and kiloamperes r.m.s. Thytron operation at average power levels far in excess of 1 MW is possible. 8 Refs.

Primary Keywords: High $\text{d}I/\text{dt}$; Low Jitter; High Currents; Very High Power; Triggering; Pulse Charging

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

224
(ENERGY CONVERSION, ELECTRICAL: POWER CONDITIONING)

(Charging Circuits; Pulse Transformers)
OFF-RESONANCE TRANSFORMER CHARGING FOR 250-KV WATER BLUMLEIN

F.G. Cook and L.L. Replogle
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1512-1517 (10/1979).

An off-resonance transformer for charging a 250-kV Blumlein system provides a viable alternative to other charging schemes by permitting the use of conventional thytrons. Such a transformer must have reliability, a reasonable voltage step-up, and a non-reversing primary current. This paper presents the analysis, design, and performance data for such a transformer. The strong interaction between the thytron design and Blumlein requirements necessitates that Blumlein specification and design criteria be briefly presented prior to transformer design such that transformer load requirements be defined. 3 Refs.

Primary Keywords: Off-resonance Transformer; Non-reversing Primary Current; Thytron Switching; Blumlein Line

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

225
(PULSE GENERATORS)
(Capacitive)

A SIMPLE, FAST RISE TIME, HIGH REPETITION RATE POCKELS CELL DRIVER

B. Plourde, M.E. Mack and E. Verre
Avco Everett Research Lab, Inc., Everett, MA 02149
The Review of Scientific Instruments, Vol. 51, No. 4, pp 549-550 (04/1980).

A thyatron Pockels cell driver capable of optically switching Pockels cells of up to 2.5 cm aperture in 6 ns at repetition rates of up to 1000 Hz is described. The circuit is based on a modified HY-2 thyatron. 3 Refs.

Primary Keywords: Pulse Generator; Thyatron; 5 kV Operating Voltage; 6 ns Rise Time. Reproduced: Low Energy

Secondary Keywords: Pockels Cell Driver

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

231
(SWITCHES, CLOSING; SWITCHES, OPENING)

(Gas Gap; Electrical; Gas Gaps, Magnetic Field)
ADVANCES IN THE DEVELOPMENT OF A GAS DISCHARGE SWITCH HAVING A REPEITIVE CURRENT INTERRUPTING CAPABILITY

R.F. Ceristi, R.P. Simon and D.V. Turnquist
EG&G Inc., Salem, MA 01970

1978 IEEE Thirteenth Modulator Symposium, pp 227-234 (06/1978)

The practical applications of a repetitively openable and closable high current, high voltage switch have resulted in considerable interest in the phenomenon of current interruption in a conducting gas by the application of a transverse magnetic field to a gas discharge channel. Such a switch is formed by a series-connected protective cover, a switchable Zener diode, a mechanism for the generation of voltage with pulses at high power levels, and as a current source for high power, high voltage sources, the physical basis for magnetic current interruption has been shown to be the action of the $J \times B$ force on the pulse-on conductor. This force serves to drive the gas against a suitably chosen channel sidewall such that the impedance of the discharge rapidly increases as reconnection takes place. The geometry of the discharge channel is thus important in the design of a practical magnetic interrupter. 8 Refs.

Primary Keywords: Gas Gap; Operating Switch; Transverse Magnetic Field

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

233
(SWITCHES, CLOSING)

(Thytrons)

DEVELOPMENT OF A FORTY KILOVOLT MEGAWATT AVERAGE POWER THYRATRON

(MAPS-40)

J. Hamilton (1), S. Merz (1), R. Flante (1), D. Turnquist (1), H. Reinhardt (2), J. Creeden (3), and J. McGowan (3)

(1) EG&G Inc., Salem, MA 01970

(2) Consultant, Lexington, MA

(3) FGOM, Fort Monmouth, NJ 07703

1978 IEEE Thirteenth Modulator Symposium, pp 135-143 (06/1978).

The thyatron which resulted from the MAPS-40 Megawatt Average Power Switch development effort achieved switching of 40 kV and 40 kA with a pulse width of 10 microseconds and a repetition rate of 125 Hz. Operation was in 10-to-15-second bursts at the 1-megawatt average power level. The MAPS-40 embodies new engineering solutions to the problems encountered in high power thytrons. In their development, careful attention had to be paid to the control of operating dissipation, to the storage and dispersal of heat, to the strength and protection of internal tube structures, and to the special requirements of tube and circuit operation at the megawatt level. In the first phase of the program, eight thytrons were constructed, five of which were delivered to Fort Monmouth for evaluation. Four of these prototype tubes were tested to the specified objectives in short-burst operation, and were subjected to further tests to explore their nominal design capabilities. Seven more tubes have since been built, all of the same design, all of which have met the specified objectives. 3 Refs.

Primary Keywords: MAPS-40 Thyatron; Ceramic Thyatron; Repetited;

High Average Power; Design Considerations

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

235
(SWITCHES, CLOSING)

(Thytrons)

DOUBLE GAP METAL ENVELOPE THYRATRONS

R.J. Whelton
English Electric Valve Co Ltd, Chelmsford, Essex, UK

1978 IEEE Thirteenth Modulator Symposium, pp 113-116 (06/1978).

The metal envelope thyatron has established itself as a versatile switch capable of high power service over a wide range of duties. The compact barium aluminate cathode used in these tubes gives a long life at both high peak and high average currents and the metal envelope provides efficient electrode cooling under these conditions. A compact high content gas reservoir system allows direct switching at high current without gas starvation. A "boxed in" anode with the high voltage insulator behind the anode prevents material sputtered by ion bombardment in the presence of inverse voltage from degrading the insulation. This range of tubes now includes two new higher voltage versions, the types described as CX1535 which is capable of 3500 A at 70 kV and the CX1536 10,000 A at 70 kV, at 5 and 10 kA continuous average current respectively. It describes the grids and gradient grids which enable very short recovery times for tubes of their size (of the order of 25 microseconds), allowing operation at power in excess of 10 kHz. An alternative method of tube operation is described as a single gap triple grid tube, which further improves the recovery time and screens the control from fast rates of change of anode voltage. 2 Refs.

Primary Keywords: Metal Envelope; Electrode Cooling; Boxed In Anode;

Design Considerations

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

236
(ELECTRICAL BEAMS, ELECTRUM)

(General)

CHARACTERIZATION OF ELECTRON AND ION CURRENT FLOW IN VERY LARGE ASPECT-RATIO FERRANTI DIODES EMPLOYING HEATED AND UNHEATED ANODES

R.D. Gerusario and V.L. Bailey
Physic International Co, San Leandro, CA 94577

Applied Physics Letters, Vol. 33, No. 8, pp 694-696 (10/1978).

Electron-beam-focusing experiments using tapered hollow cathodes have been performed at power levels exceeding 10^{12} W and with diode aspect ratios (radius/anode-cathode spacing) of 24 and 45 (uncorrected for plasma motion). The spatial distributions of both the electron (using collimated p-i-n diodes) and ion currents (using quartz pressure gauges and Faraday cups) were measured simultaneously. Efficient electron-beam pinches were produced at large R/d (approximately 24) using a diode configuration that employed a small-diameter cathode and heated anode. 2 Refs.

Primary Keywords: E-beam Diode; Tapered Hollow Cathode; Pinching; Cold

Anode; Heated Anode; PITMON

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

237
(SWITCHES; CLOSING)
(Thytronics)

FLANGE MOUNTING GLASS ENVELOPE HYDROGEN THYRATRONS
L.J. Kettle, C.V. Neale and B.P. Newton
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1978 IEEE Thirteenth Modulator Symposium, pp 102-104 (06/1978).
The stacked grid and anode assembly of conventional ceramic thytronics does not provide a reservoir of neutral gas near the anode which is as large as that in a glass envelope tube. In consequence, when a trip or kick-out occurs in many pulse modulator applications, the follow-through current may cause a ceramic thyatron to quench and switch in a metallic spark mode thus causing considerable damage to itself. The paper describes recently developed hydrogen thytronics which combine the advantages of the open structured glass envelope tubes, capable of high amp. second ratings for their size, with the conventional low inductance flange mountings normally associated with ceramic envelope tubes. When used in simple low inductance housing, these tubes are capable of handling rates of rise of current in excess of 50 kA/microsecond. 2 Refs.
Primary Keywords: Glass Thyatron; Low Inductance; Fast Rise; Long Pulse

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

238
(SWITCHES; CLOSING; SWITCHES; OPENING)
(Reviews; Vacuum Tubes)

HIGH POWER SWITCHING CAPABILITIES
T. Burkes, M. Kristiansen, W. Portnoy and M. Hagler
Texas Tech University, Lubbock, TX 79409
1978 IEEE Thirteenth Modulator Symposium, pp 173-179 (06/1978).
Various high power switches are compared with regard to their capabilities in terms of maximum hold-off voltage, peak current, pulse repetition rate, current rise time, coulomb handling capability and lifetime. The specific switches considered are thytronics, silicon controlled rectifiers (SCR's), vacuum tubes, ignitrons and spark gaps. Information for this study was obtained from the open literature. Emphasis is placed on a switch's capability to handle rated voltage and current simultaneously. 0 Refs.

Primary Keywords: Review; Thyatron; Thyristor; Vacuum Tube; Ignitron; Spark Gap

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

240
(SWITCHES; CLOSING; PULSE GENERATORS)

(Thytronics; Capacitive)
HIGH-POWER, HIGH-REPETITION RATE PULSER FOR PHOTO-IMPULSE IONIZED LASERS
V.E. Merchant, H.J.J. Seguin and J. Dow
University of Alberta, Edmonton, Alberta, Canada
The Review Of Scientific Instruments, Vol. 49, No. 12, pp 1631-1636 (12/1978).

The design and operational parameters of a high-power pulser suitable for a photo-impulse ionized laser are presented. The relatively compact device utilizes a ceramic thyatron in a triggered resonant charging circuit. Efficient operation at repetition rates up to 40 kHz, with pulsed powers in excess of 2 MW and average powers of several kilowatts has been achieved. 9 Refs.

Primary Keywords: Thyatron; Coaxial Mount; Low Inductance; Compact Construction; Low Energy; Rep-rated

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

244
(SWITCHES; CLOSING; BREAKDOWN STUDIES)

(Vacuum Gaps; Electrical; Vacuum, Electrical)
ELECTRON CURRENT IN DELAYED TRIGGERING OF HIGH-VOLTAGE, HIGH-VACUUM PULSED DISCHARGES
B.I. Volkov, V.B. Glasko, A.I. Dmitriev, A.B. Korshunov and E.M. Reikhrudel
Moscow State University, Moscow, USSR
Soviet Phys.-cs-Technical Physics, Vol. 16, No. 10, pp 1710-1716 (06/1972).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 2159-2166 (October 1971)

A model for the disintegration of metal vapors is used to find the maximum density of the electron beam impinging on the anode in delayed triggering of a pulsed discharge in high vacuum. Computer calculations (using an 8201) show that the maximum stable electron current density in a cold-cathode tube with a trigger electrode is an order of magnitude greater than the electron current density from a thermionic cathode (anode-to-cathode distance d = 3 cm, voltage drop between the electrodes $U_{ab} = 0$ / 30 kV). These results are found to agree with experiment. 8 Refs.

Primary Keywords: Vacuum Gap; Metal Vapor; Modeling; Electron Flow; Numerical Calculation; Cold Cathode; Heated Cathode; Space Charge Neutralization

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

246
(SWITCHES; CLOSING)

(Thytronics)
NEW DEVELOPMENTS IN SUPER-FAST, HIGH-POWER, HYDROGEN THYRATRON SWITCHING
R.F. Caristi, S. Friedman, S.S. Mertz and D.V. Turnquist
EGG Inc., Salem, MA 01970
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1427-1438 (10/1979).

Design criteria for hydrogen thytronics operating at fast rates of current rise (dI/dt), high anode voltages, and high peak currents have been theoretically and experimentally determined. The approach was to divide the investigation into two basic areas. The criteria for achieving high dI/dt were first established at relatively low voltages. Then the information necessary to incorporate features promoting high dI/dt into a high-voltage structure was determined. The principal factors affecting dI/dt are the tube's effective inductance, the nature and rate of the plasma growth, and the manner in which commutation is effected. The inductance depends on the tubes geometry and dimensions. Plasma growth is a function of geometry and gas pressure, and must be controlled in a way such that the tube is triggered and then commutes in the optimum manner for highest dI/dt . Rise rates on the order of a few times 10¹² A/s are considered feasible for properly designed tubes operating with anode voltages of 50 kV and peak currents of 10 kA. 8 Refs.

Primary Keywords: High dI/dt ; High Peak Current; Tube Geometry Consideration; Current Computation; Rep-rated

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

247
(PARTICLE BEAMS; ELECTRON; POWER CONDITIONING; PULSE GENERATORS)
(Generator; Systems; Pulse Forming Lines)

DESIGN STUDY FOR AN AURORA MODIFICATION LEADING TO A 100-TERAWATT NUCLEAR WEAPON RADIATION SIMULATOR
A.G. Stewart and G.A. Huttlin
Harry Diamond Labs, Adelphi, MD 20783
HDL Report No. HDL-TH-94-3 (02/1979).
Availability: AD-A071339
NTIS

250
(ENERGY STORAGE; MECHANICAL; PULSE GENERATORS)
(Rotating Machines; Rotating Machines)
DETAILED DESIGN, FABRICATION AND TESTING OF AN ENGINEERING PROTOTYPE COMPENSATED PULSED ALTERNATOR

H.L. Bird and H.H. Woods
University of Texas at Austin, Austin, TX 78712

LLL Final Report on Contract W-7405-ENG-48 (03/1980).

The design, fabrication, and test results of a prototype compensated pulsed alternator are discussed. The prototype alternator is a vertical shaft single phase alternator with a rotating armature and salient pole stator. The machine is designed for low rep rate pulsed duty and is sized to drive a modified 10 cm Peta amplifier. The load consists of sixteen 15 mm x 20 mm x 112 cm long xenon flashlamps connected in parallel. The prototype alternator generates an open circuit voltage of 6 kV, 180 Hertz, at a maximum design speed of 5400 rpm. At maximum speed, the inertial energy stored in the alternator rotor is 3.4 MJ. 1 Refs.

Primary Keywords: Compensator; High Power; Laminated rotor;

Compensating windings; high average flux density;

Time varying armature circuit

Secondary Keywords: Pulse shaping; Simulation; Magnetic field mapping; Design notes

251
(SWITCHES; CLOSING)
(Thytronics)

THYRATRONS FOR SHORT PULSE LASER CIRCUITS

H. Menoun and C.V. Neale
English Electric Valve Co Ltd, Chelmsford, Essex, UK

1978 IEEE Thirteenth Modulator Symposium, pp 125-128 (06/1978).

The conventional thyatron is a unidirectional switch; therefore when circuit design demands large current reversals (as in many short pulse laser drivers) arc back, or positive ion sweeping of the anode surface causes metallic sputtering which soon leads to a degradation of forward voltage hold-off. The range of tubes described which is designed to overcome this circumstance by storing plasma during the forward pulse within a hollow anode is depicted. A schematic diagram of the anode structure is shown. It is shown that by careful design of the anode geometry, a form of bi-directional operation, without loss of forward voltage hold-off, can be obtained. Information is given concerning circuits suitable for operating these thytronics, principally in order to avoid problems associated with recovery time. 0 Refs.

Primary Keywords: Ceramic Thyatron; Bidirectional Operation; Short Pulse

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

257
(PULSE GENERATORS)

(Line Type)

A 1200 MEGAWATT VAN-MOUNTED LINE-TYPE MODULATOR

P.A. Corbiero, R.E. Kolbas and J.J. Moriarty
Paytheon Co, Bedford, MA 01730

1978 IEEE Thirteenth Modulator Symposium, pp 260-263 (06/1978).

A line-type modulator is described which operates from a 4160 V AC source and delivers repetitive 12 kJ pulses to a remote load. The module and its controls are self-contained in a 45 foot long environmentally controlled, trailerable van. The pulser is comprised of fourteen thyatron-switched modulators, command-charged from a common source and coupled to the load by means of a single output transformer and cable. Test equipment has been developed which provides system shutdown and fault identification in the event of thyatron malfunction, load failure or charging imbalance. The module has been operated onto a resistive load at the following levels: Output Voltage = 165 kV, Energy per Pulse = 12 kJ, Pulse Repetition Rate = 5 g/s, Shot to 25 pps, Burst Duration = 10 s, Pulse duration = 10 microseconds and 20 microseconds. 0 Refs.

Primary Keywords: Line-Type Modulator; Portable; Hydrogen Thyatron; High Voltage; System Protection; Command Charge; Modular Construction; Rep-rated

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

259

COMPACT MEGAWATT AVERAGE POWER PULSE GENERATOR

J.E. Creedon, J. McGowan, A.J. Buffa and S. Schneider

ECO4, Fort Monmouth, NJ 07703

Research and development technical rept. No. DELET-TR-78-26, 6p (11/1978).

Availability: AD-A065 113/3ST

NTRS

No abstract available.

Primary Keywords: Pulse Generators; Modulators; High Power

Secondary Keywords: Burst Mode; PFN(Pulse Forming Networks); NTISDODXA

263

(SWITCHES; CLOSING)

(Gas Gaps; Electrical)

LOW INDUCTANCE SPARK GAP SWITCH FOR BLUMLEIN-DRIVEN LASERS

J.W. Kerr, T.D. Raymond and S.T. Walsh

University of Texas at Austin, Austin, TX 78712

The Review Of Scientific Instruments, Vol. 51, No. 1, pp 42-43 (01/1980).

We report the design of a low inductance spark gap switch for Blumlein-driven lasers which is highly reliable under conditions of high repetition rate and high average power. The reported spark gap has provided reproducible pulse waveforms without maintenance for 10⁸ shots at a Blumlein-driven nitrogen laser. When operated with a nitrogen-SF₆/sub 6 mixture in the laser tube, this laser provided peak powers in excess of 3 MW at 5-Hz repetition rate and an average power of 0.5 W at 120-Hz repetition rate. 4 Refs.

Primary Keywords: Low Inductance; Copper Electrodes; Nitrogen Gap; Insulator Shield; Rep-rated; Blumlein-line

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

267

(SWITCHES; CLOSING)

(Thytronics)

HIGH RATE OF RISE OF CURRENT PULSE GENERATION USING LOW COST GLASS ENVELOPE THYRATRONS

R.L. Snelling (1), B.P. Newton (1), A. Andrews (2) and I. Littlewood (2)

(1) English Electric Valve Co Ltd, Chelmsford, Essex, UK

(2) Clarendon Lab, Oxford, UK

1978 IEEE Pulsed Power Conference Proceedings, Paper IB-5 (11/1978).

The front edge switching capability of glass thytronics can be extended many times by sheet metal anode mountings and drive circuits. The paper is a practical approach to the problem involved and contains mounting details and circuits for specific tubes along with some general theory. Detailed results are described of an experiment which compares the switching capabilities of spark gaps and glass thytronics when used to discharge currents through a lensing medium such as a helium/nitrogen mixture. 0 Refs.

Primary Keywords: Glass Thyatron; Fast Current Rise; Pulse Generator

Copyright: 1978 IEEE, REPRINTED WITH PERMISSION

296
(PARTICLE BEAMS; ION; PARTICLE BEAMS, ELECTRON)
(Generation; Target Interactions)
DIELECTRIC GUIDE CONTROLLED COLLECTIVE ION ACCELERATION
Spire Corp., Bedford, MA 01870
AFML Report No. AFML-TR-77-248 (02/1980).
Availability: AD A084994
NTIS

Experiments performed at Spire and at NRL have demonstrated dielectric guide controlled collective ion acceleration. Control of the phenomenon has been established by varying the electron beam parameters or guide geometry. Specifically, it has been shown that: Total electron current must exceed the space charge limit; a minimum electron current density is required; increasing guide length (assuming the electron beam can propagate to the end) increases ion energy; increasing guide radius at constant electron current decreases ion energy; and, the energy or charge deposited per unit area of wall controls the velocity of propagation of the electron beam front and, therefore, the energy of the ions. NRL VEBA results show that: Dielectric guide controlled collective ion acceleration is effective at higher electron beam energies; an electron beam with current pinched on axis is more efficient for ion acceleration; and, molding the surface of the guide can control the beam front velocity. 18 Refs.

Primary Keywords: Unconventional Accelerators; Collective Effect Acceleration; Dielectric Guide Control

298
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks; Capacitor Banks)
A 230 kJ PULSED POWER SUPPLY

R. Minja
Fermi National Accelerator Lab., Batavia, IL 60510
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 1317-1320 (06/1975).
The Mason Focusing System (horn), consisting of two single-turn coaxial structures, in which circular magnetic fields of varying intensity are produced, and a 230 kJ pulsed power supply have recently been built and operated at Fermilab. The development and construction of the power supply and its related control system is reported in this paper, while a companion paper published in these proceedings reports on the design and development of the magnetic structure (horns) and the interconnecting transmission line. The capacitor discharge series resonant network was chosen because of the ability to generate the required high current at a relatively modest voltage. Ignitrons are used as the switching elements. A dual set of ignitrons and their controls are connected to the capacitor bank which allows the time-shared operation of the power supply into two loads without the necessity of mechanical, high-current switching. The ultimate load for the power supply is a test area where development work on new horn system components is carried out. The power supply is located outside the Neutral Laboratory target Hall where the capacitor bank and igniton switches are safely positioned in an isolated room. The associated support equipment is adjacent to the bank room. 2 Refs.

Primary Keywords: Series Resonant Network; Capacitor Discharge; Ignitron Switch; Croubar; Modular Construction

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

299
(PULSE GENERATORS)
(Capacitive)
CONSTANT PULSE ENERGY POWER SUPPLY FOR A HIGH REPETITION RATE LASER SYSTEM

C.C. Lo and B. Fan
Lawrence Berkeley Lab., Berkeley CA
The Review Of Scientific Instruments, Vol. 47, No. 1, pp 63-65 (01/1976).

A pulsed power supply system with constant pulse energy has been developed to drive flashlamps in a 0.5-5 pulses per second Nd:glass laser. By using a stable, absolute reference voltage source to set the trigger level, the energy discharged through the flashlamps is kept constant despite pulsing frequency change, power line fluctuation, and minimum DC power supply regulation. The concept can be expanded or adapted to operate other similar systems. 4 Refs.

Primary Keywords: Capacitor Charging; Excellent Pulse Repeatability; Slow Discharge; Output Pulse; Reprated

Secondary Keywords: Nd-glass; Laser Pumping
COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

303
(DIAGNOSTICS AND INSTRUMENTATION)

(Component Testing)
EMP SUSCEPTIBILITY OF INTEGRATED CIRCUITS

C.R. Jenkins and D.L. Durbin
BDM Corp., Albuquerque, NM 87106
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 6, pp 2494-2499 (12/1975).

This paper summarizes the results of a major test program which involved the measurement of the pulse power failure thresholds of 41 integrated circuit types, representing seven logic families. The pulse widths used in these tests ranged from 0.1 microseconds to 10 microseconds. The failure threshold data have been grouped by logic family and test terminal to form failure categories. A simple failure model has been developed which is useful in predicting the failure thresholds of untested devices. 9 Refs.

Primary Keywords: Digital Integrated Circuits; EMP Testing; Failure Modes; Microsecond Pulse Widths; Modeling

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

308
(PARTICLE BEAMS, ELECTRON)

(Generation)
PULSED MICROSECOND HIGH-ENERGY ELECTRON BEAM ACCELERATOR

T.H. Martin and R.S. Clark
Sandia Lab., Albuquerque, NM 87115
The Review Of Scientific Instruments, Vol. 47, No. 4, pp 460-463 (04/1976).

Electron beams delivering up to 60 kA at 1.5 MV with pulse durations of 0.5-1.5 microseconds were obtained by connecting a low-inductance Marx generator directly across a vacuum diode. Beams with up to 44 kJ and conversion efficiencies up to 51% from Marx energy into electron beam energy were obtained. 11 Refs.

Primary Keywords: Marx Generator; Field Emission Diode; 1.5 Microsecond Pulse Length; No Intermediate Store
COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

311
(PULSE GENERATORS)
(Capacitor Banks)

AN INEXPENSIVE PULSED POWER SUPPLY FOR A SEPTUM MAGNET
W.F. Praelo
Argonne National Lab., Argonne, IL
IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 1307-1310 (06/1975).

A 16 microhenry, 6 million ohm septum magnet load must be pulsed via extracting beam from the 200 Mev booster of the Zero Gradient Synchrotron (ZGS). A power supply was designed for this purpose that can deliver approximately 2 ms wide, half sine wave pulsed with a PRF of 30 pulses per second. The peak current is adjustable from 3 kA to 13 kA and repeatable within $\pm 0.05\%$ by means of a novel charging circuit. By providing a transformer between the magnet and the capacitor bank, the overall cost of the system was reduced to less than one half of that of a conventional capacitor discharge system. A high-Q choke shunts the negative half wave of the current around the transformer thereby extending the life expectancy of the magnet and increasing the circuit efficiency. 4 Refs.

Primary Keywords: Capacitor Bank; Step-down Transformer; Half-sinusoidal Waveform; Inductive Load; Rep-rated

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

317
(PULSE GENERATORS; POWER CONDITIONING)

(Line Type; Saturable Reactors)
GENERATOR PRODUCING NANOSECOND PULSES WITH AN INCREASED REPETITION FREQUENCY

I.G. Ketaev and I.I. Rozhkov
Gorki Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 17, No. 4, pp 1037-1038 (08/1974).
Trans. From: Priroda i Tekhnika Eksperimenta 4, 88-89 (July-August 1974).

A generator is described which produces rectangular nanosecond pulses and is designed for operation into an arbitrary load. The principle of contraction of electromagnetic energy and the formation of electromagnetic shock waves in transmission lines with ferrite is used in the generator. The power of the output pulses is 3 kW, and the maximum repetition frequency is 25 kHz. 4 Refs.

Primary Keywords: Rectangular Pulse; Thyatron; Ferrite; Electromagnetic Shock Wave; 3 kW Output Power; Rep-rated

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

323
(INSULATION, MATERIAL)

(Solid)

THE RESEARCH IN DISCHARGE SUPPRESSION OF HIGH VOLTAGE CRSSLINKED POLYETHYLENE INSULATED POWER CABLE

S. Fujiki, H. Furusawa, T. Kubota and H. Matsuba
The Furukawa Electric Co. Ltd., Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 6, pp 2703-2709 (12/1971).

The main reason why high voltage plastic power cables lead to the dielectric breakdown is considered the insulation deterioration which is brought about by partial discharges within voids and other anomalies. We have taken various measures in order to suppress these partial discharges. Then we got an idea that when some semi-conductive organic materials are blended in the insulation material, the dielectric resistivity of both the insulation and between the insulation and semi-conductive layer is reduced. Our study based on this idea produced effectual results. This paper describes the theoretical analysis, fundamental experiments and application experiments to cables and cable joints. 4 Refs.

Primary Keywords: Crosslinked Polyethylene; Partial Discharge; Insulation Deterioration; Semi-conductive Organic Material

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

327
(PULSE GENERATORS; POWER CONDITIONING)

(Capacitive; Pulse Transformers)

A NOMINAL ONE-MEGAVOLT, PULSED POWER GENERATOR

T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 104-105 (03/1971).

A pulsed voltage generator, called Frizz, has been designed and constructed at Sandia Laboratories and is now being used as a voltage source for breakdown studies of various materials. Frizz generates a nominal 100 ns pulse of variable rise time from 5 to 50 ns across a vacuum chamber in which dielectric test samples are placed. 4 Refs.

Primary Keywords: Variable Rise Time; Series Inductor; Spark Gap; Capacitor Energy Store; Pulse Transformer

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

333
(BREAKDOWN STUDIES)

(Gas; Optical)

OPTICAL BREAKDOWN OF COMPRESSED GASES BY CO/SUB 2/ LASER RADIATION

N.G. Besov, E.M. Belov, V.A. Danil'ychev, O.M. Karimov and I.B. Kovsh
F.N. Labedev Physics Institute, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Physics JETP, Vol. 36, No. 6, pp 1061-1063 (06/1973).

Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 63,

2010-2014 (December 1972).

The breakdown of compressed gases by CO/sub 2/ laser radiation was investigated theoretically and experimentally. The high-pressure breakdown ($P > 30$ atm) differed considerably from the breakdown in low-pressure gases. The threshold flux density and the energy of the radiation, which were decreasing functions of P at low pressures, increased with P at high pressures. The pressure dependences of the threshold density and energy of the radiation were different for molecular and atomic gases. 10 Refs.

Primary Keywords: Volume Breakdown; Several Gases; 30 atm Pressure Range; Molecular Gas; Atomic Gas; Experiment; Theory

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

334
(PULSE GENERATORS; POWER CONDITIONING)
(Reviews: Pulse Forming Lines)

PULSED POWER GENERATORS

L.S. Levine and M.G. Ury
Naval Research Lab., Washington, DC 20375
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 1, pp 456-462
(02/1973).

Pulse power generators are capable of delivering as much as megajoules of energy in pulses of 100 nsec or less. A brief review of the technological approach to this problem is presented, as well as the description of three different devices: Gamble II, AURORA, and a small laboratory device designed at NRL. 21 Refs.

Primary Keywords: Review; Marx Generator; L-C Generator; Blumlein Line; Pulse Forming Line; Gamble II; AURORA

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

335
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generations; Reviews)

PULSED POWER TECHNOLOGY FOR CONTROLLED THERMONUCLEAR FUSION

L.S. Levine and I.M. Vitkovsky
Naval Research Lab., Washington, DC 20375
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 4, pp 255-264
(04/1971).

Over the past few years, the technology of pulsed power generators has been developed to the level where it is possible to produce powers on the order of 1E12 W for times on the order of 1E-7 sec. Such generators are most commonly utilized to produce intense relativistic electron beams, and this paper briefly surveys the existing state of the art of generators and relativistic beams. As examples, recent work at NRL is considered in some detail. Finally, several potential applications of this technology in controlled fusion research will be discussed. 38 Refs.

Primary Keywords: Relativistic Electron Beam; Review; Marx Generator; Pulse Forming Line; Field Emission Diode; Drift Tube

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

336
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Capacitor Banks; Capacitor Banks)

PULSE GENERATOR PRODUCING A HIGH-POWER CURRENT
A.M. Andrianov, V.F. Demichev, G.A. Eliseev, P.A. Levit, A.Yu. Sokolov
and A.K. Terent'ev
Instruments And Experimental Techniques, Vol. 14, No. 1, pp 124-126
(02/1971).

Trans. From: Priroby i Tekhnika Ekspertimenta 1, 112-114
(January-February 1971)

A capacitor bank made up of 16 low-inductance KMK-30-8 capacitors is described. For comparatively low energy capacity of 58 kJ the bank has an intrinsic stored energy pulse power of 1.4E11 W and a short-circuit current of 3.5 MA. Low-inductance vacuum spark gaps serve as the current commutators. 5 Refs.

Primary Keywords: Capacitor Bank; 58 kJ Stored Energy; 1E11 W Output; 3.5 MA Short Circuit Current; Vacuum Spark Gap; Low Inductance

COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION

339
(SWITCHES, OPENING)

(Plasma Erosion)

PLASMA EROSION SWITCHES WITH IMPLODING PLASMA LOADS ON A MULTITERAWATT PULSED POWER GENERATOR

R. Stringfield, R. Schneider, R.D. Genuario, J. Roth, K. Childers, C. Stalling and D. Dehne
Physical International Co., San Leandro, CA 94577

Journal Of Applied Physics, Vol. 52, No. 3, pp 1278-1284 (03/1981).
Plasma erosion switches have been fielded on the PITMON generator during imploding plasma experiments. Theta pinch plasma guns were used to inject carbon plasmas of densities in the range of 1E12 - 1E13 cm.⁻³ between the electrodes of the vacuum or feed region, upstream from an imploding plasma load. Current monitors indicated that the erosion switches carried substantial current early in time, diverting it from the load. Late in the pulse the erosion switches opened, transferring the current to an imploding plasma with the effect of sharpening the current rise time at the load. Associated with the sharper rise time was an improvement in the quality of the plasma implosions. The results of varying the density and total number of particles entering the plasma of the switches are presented with regard to the effect on the current along the vacuum feed and on the behavior of vacuum flowing electrons. 5 Refs.

Primary Keywords: Plasma Erosion Switch; Opening Switch; PITMON; Fast-rise; Experiment; Theory; Plasma Density Dependence

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

351
(PULSE GENERATORS)

(Line Type)

HIGH-VOLTAGE PULSE GENERATOR FOR WIRE SPARK CHAMBERS
Y.D. Karpekov, G.P. Makarov, Y.N. Simonov and V.P. Sugonyayev
GFAE Atomic Energy Institute, Moscow, USSR
(02/1975).

Availability: IFVE-PEP-75-130
NTIS

A HV pulse generator for power supply of wire spark chambers with pulsed hydrogen thyratron and discharge line in the end cascade is described. The generator forms the pulses of negative polarity with the rise time of 30 nsec, with 170 nsec duration, stabilized pulse-height that may be changed within the limits from 4 up to 6 kV and time delay of about 100 nsec with respect to the triggering signal. (Atomindex citation 09:361077)

Primary Keywords: High-voltage Pulse Generators; Wire Spark Chambers; Delay Circuits; Digital Pulse Line; Pulse Shaping Circuits; Thyratrons; Timing Properties

Secondary Keywords: IN RUSSIAN, ERDA/460104; USSR, NTISINIS

Distribution Restriction: U.S. SALES ONLY.

378
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Vacuum, Electrical)

ELECTRON BEAM GUN SIMULATION

T.E. Springer and W.J. Sargent
Los Alamos National Lab., Los Alamos, NM 87545
LAST Report: E-DO-740-80 (01/1981).

Availability: E-DO-740-80

LAC

A numerical simulation of a small, hot-cathode electron beam gun is presented. Since the time required for the electric field to propagate into the structure is short compared to the pulse widths of interest (a few nanoseconds compared to 100 microsecond pulse widths), electrostatic field and potential calculations are made and space charge is ignored. Calculated E-field and potential plots are shown, along with equipotential and electron trajectory diagrams. Agreement with experiment is good. Suggestions are presented for improving beam uniformity and increasing breakdown potential in similar devices. 2 Refs.

Primary Keywords: Hot Cathode; Long Pulses; Simulation; Fields Plots

Secondary Keywords: Electron Trajectories; Laplace's Equation; Laser Pumping; Continuous Cathode Voltage

392
(INSULATION, MATERIAL; BREAKDOWN STUDIES)

(Gas; Gas, Electrical)

A CIRCUIT WHICH PREDICTS AND DIVERTS FLASHOVER FROM A LONG AIR GAP
G. Jervis-Hunter
Marchwood Engineering Lab., Southampton, UK
The Review Of Scientific Instruments, Vol. 45, No. 3, pp 403-405
(03/1974).

A fast, rugged, electronic circuit is described which predicts an impending switching surge flashover in a long air gap and diverts the discharge energy into a triggered bypass gap. Prediction is based on the amount of charge injected into the gap by the high voltage electrode. A protective gap could be designed which would operate only if the insulation being protected were about to fail. This could significantly improve the techniques of insulation coordination and has important implications for studies of the mechanisms of the long spark. 2 Refs.

Primary Keywords: Air Gap; Self-breakdown; Bypass Gap; Displacement Current; Corona Current; Current Detection; Breakdown Prevention

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

393
(PULSE GENERATORS)

(Systems)

A GENERATOR FOR STARTING ACOUSTIC CHAMBERS
V.H. Afanasyev, O.N. Kryzhanovskii, P.I. Lebedev, V.I. Orel'chikov and Yu.F. Tomashchuk
Institute Of Theoretical And Experimental Physics, Moscow, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1427-1429
(10/1973).

Trans. From: Priroby i Tekhnika Ekspertimenta 5, 111-114
(September-October 1973)

A generator is described for starting acoustic chambers using a TGII-100/025 thyratron as the commuting element. The overall delay of the circuit is approximately equal to 160 nsec; the maximum operating frequency, which is determined by the high-voltage rectifiers, is approximately equal to 50 Hz. 3 Refs.

Primary Keywords: Delay Generation; 5 kV Operating Voltage; Thyratron; Reproduced

Secondary Keywords: Acoustic Spark Chamber

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

394
(SWITCHES, CLOSING)

(Thyristrons)

A MULTIGAP, DOUBLE-ENDED, HYDROGEN THYRATRON
H. Menown and B.P. Newton
English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE 1973 Eleventh Modulator Symposium pp. 232-235 (09/1973).

This paper discusses the limitations of conventional ceramic thyristrons with regard to inverse voltage and describes a double-ended, multigap thyristron capable of conduction in both directions. This new device behaves as a triggered, bidirectional switch and so improves commutation and simplifies circuit design. Methods of triggering, excitation and protection are described. 8 Refs.

Primary Keywords: Multigap Thyristron; Double-ended Thyristron; Conduction In Both Directions

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

398
(ENERGY STORAGE)

(Reviews)

CONTEMPORARY CAPACITIVE ENERGY STORAGE SYSTEMS

E.L. Kemp
Los Alamos National Lab., Los Alamos, NM 87545
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 1, pp 446-451
(02/1973).

Capacitive energy storage is one of the oldest forms of energy storage for pulsed power requirements. Most energy storage capacitors are made of Kraft paper and aluminum foil and impregnated with castor oil. A typical capacitor stores approximately 3000 joules at voltage ratings of 10kV-100 kV. Two types of switches are used for capacitor bank switching: ignitrons and vacuum contactors. Ignitrons are commercially available, have a wide voltage operating range and are easy to trigger. However, they are limited to approximately 20 kV for most applications and they will prefire. Spark gaps can be designed for reliable operation at almost any voltage level but they are rarely commercially available. Most spark gaps do not operate satisfactorily below 50% of their design voltage and they require a more complicated trigger system than ignitrons. Low inductance coaxial cable has been developed for capacitor bank transmission systems. It is relatively inexpensive and commercially available. Parallel plate transmission lines can be designed to accumulate large amounts of current and conduct it to a concentrated load but careful attention must be given to the containment of the magnetic forces involved. 9 Refs.

Primary Keywords: Capacitor; Ignitron; Spark Gap; Coaxial Cable; Strip Line

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

399
(PULSE GENERATORS)

REVIEW: DESIGN CONSIDERATIONS FOR SUPER POWER PULSE MODULATORS

D.L. Pruitt, Moorestown, NJ 08057

RCA Corp., Moorestown, NJ 08057

IEEE 1973 Eleventh Modulator Symposium (09/1973).

Design criteria are discussed which are particularly pertinent to super power artificial line-type modulators. A sample design is illustrated which uses 60 hydrogen thyratrons switch tubes in 30 unit modulators to supply 2.5 gigawatts peak power and 10 megawatts average power. A concept physical layout is shown for the sample design. 0 Refs.

Primary Keywords: Line-type Modulator; Design Considerations; Super Power; Thyratron; Spark Gap; End-of-line Clipper; Pulse Transformer; Charging Network

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

402
(PARTICLE BEAMS, ION)
(Generation)

PULSED ION DIODE EXPERIMENT

D.S. Prino, J.W. Shearer and R.J. Bridges

Lawrence Livermore Lab., Livermore, CA 94550

Physical Review Letters, Vol. 37, No. 1, pp 21-25 (07/1976).

Experiments in ion generation with a reflex-diode are presented. The DHL II generator was used to generate ion beams with total ion current up to 150 kA. Two modes of operation were seen. The first 50 nsec of operation are as a normal diode, then the impedance drops (accompanied by ion flow). An explanation is given for this behavior. 12 Refs.

Primary Keywords: Ion Diode; 300 kV Voltage Range; Reflex-triode; Experiment; Theory; Magnetic Stabilization; Several Anode Foils

COPYRIGHT: 1976 THE AMERICAN PHYSICAL SOCIETY

403
(PULSE GENERATORS; SWITCHES, CLOSING; POWER CONDITIONING)

(I.G.; Thyatrons; Pulse Forming Networks)

GENERATION OF HIGH CURRENT, LONG DURATION RECTANGULAR PULSES

P.E. Paugeres, H. Kuhn and J.F. Zanasco

CERN, Geneva, Switzerland

IEEE 1973 Eleventh Modulator Symposium pp. 23-28 (09/1973).

The excitation of the fast pulsed kicker magnets foreseen for the CERN 400 GeV proton synchrotron requires rectangular pulses with a current amplitude of 3000 A to 10000 A, a pulse duration adjustable between 1 and 24 microseconds, and short rise and fall times. These pulses are generated by a LC ladder network discharged with fast switches. Several kinds of switches have been tested: multigap thyatrons of standard design, a composite switch called thyragnitron and made of a normal thyatron bypassed by ignitrons, and finally special thyatrons with a second cathode assembly in place of the usual anode. Experimental pulse shapes and results of life tests for these different switches are presented and discussed. 8 Refs.

Primary Keywords: LC Generator; Multigap Ignitron; Thyatron;

Thyragnitron; Life Test; PFR

Secondary Keywords: Proton Synchrotron

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

413
(ENERGY STORAGE, CAPACITIVE)

(Capacitors)

VOLTAGE INDUCED CAPACITANCE FLUCTUATIONS IN A COMPRESSED GAS, HIGH VOLTAGE CAPACITOR

J. Runnis and D.E. Brown

National Measurement Lab., Sydney, Australia

Journal Of Physics E: Scientific Instruments, Vol. 8, pp 16-17 (01/1975).

Capacitance fluctuations of the order of a few parts/million have been observed in a 330 kV capacitor after operating at 300 kV for 30 min. It has been concluded that the capacitance fluctuations are due to convection of the compressed $\text{CO}_2/\text{sub} 2/\text{gas}$, caused by dielectric heating of the insulating walls. 0 Refs.

Primary Keywords: Compressed Gas Capacitor; $\text{CO}_2/\text{sub} 2/\text{Dielectric}$; Guard Electrode; Capacitance Fluctuation; 300 kV Voltage Range

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

414
(SWITCHES, CLOSING)

(Thyatrons)

THE DISCHARGE CURRENT DISTRIBUTION OVER THE SURFACE OF THE ELECTRODES OF A HYDROGEN THYRATRON DURING A PULSE

A.M. Isakov'skiy, Yu.E. Nesterikhin, L.B. Rukovets, V.I. Sekerkin and T.B. Fogel'son

Radio Engineering And Electronic Physics, Vol. 17, No. 6, pp 998-1002 (04/1972).

Experiments were performed in which the current distribution over electrode surfaces in a hydrogen thyatron was examined. Pulses applied to the device lasted 30 microseconds with current varying from 200 to 2400 A. High-speed photography was used to note that the current at the anode formed a filament which rotated around the tube during the pulse. Current at the cathode did not change during the pulse. Hydrogen pressure was also varied during the tests. 8 Refs.

Primary Keywords: Thyatron; High-power; Nonuniform Current Distribution; Grid Distribution; Anode Distribution; Moving Current Filament; Current Variation; Pressure Variation

COPYRIGHT: 1971 PERGAMON PRESS

417
(SWITCHES, CLOSING)

(Thyatrons)

THE USE OF HYDROGEN THYRATRONS AS HIGH SPEED, HIGH VOLTAGE RECTIFIERS

H. Menken and G.J. Scales

English Electric Valve Co Ltd, Chelmsford, Essex, UK

IEEE 1973 Eleventh Modulator Symposium pp. 236-238 (09/1973).

The necessity for a high forward current, fast reverse recovery diode arose during the design of a thyatron test modulator. This paper describes how such a diode can be obtained by the use of hydrogen thyatrons in a parallel assembly. 0 Refs.

Primary Keywords: High-voltage Rectifier; Hydrogen Thyatron; High Current; Very Fast Switching

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

418
(PULSE GENERATORS)

(Line Type)

THYRATRON GENERATOR THAT PRODUCES RECTANGULAR PULSES HAVING A SMOOTHLY CONTROLLABLE LENGTH

R.S. Technik
Instruments And Experimental Techniques, Vol. 16, No. 4, pp 1124-1126 (08/1973).

Trans. From: Pribory i Tekhnika Eksperimenta 4, 120-122 (July-August 1973).

The circuit of a powerful generator producing rectangular pulses is described which is implemented using pulsed hydrogen thyatrons with partial discharge of a storage capacitor. The circuit allows rectangular pulses to be obtained having a leading edge duration of approximately 0.1 microsec for output currents of up to tens of amperes and voltages of up to several kilovolts and allows smooth control of the pulse length from several microseconds to several milliseconds. 4 Refs.

Primary Keywords: Rectangular Pulse; Thyatron; Microsecond-millisecond Pulse Duration; Capacitor Bank; Pulse Shaping

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

419
(PULSE GENERATORS)

(Capacitive)

THYRATRON GENERATOR WHICH PRODUCES HIGH-VOLTAGE LONG PULSES FOR HIGH- Ω LOADS

I.Z. Gogolitzyn and A.V. Senin

Leningrad Electrical Engineering Institute, USSR

Instruments And Experimental Techniques, Vol. 15, No. 5, pp 1397-1398 (10/1972).

Trans. From: Pribory i Tekhnika Eksperimenta 5, 97-98 (September-October 1972).

A thyatron generator which shapes rectangular pulses having an amplitude of up to 20 kV across a high- Ω load of 1E6 to 1E8 ohm is described. The length of the pulse is controlled smoothly in the range from 20 to 2000 microsec. The duration of the leading and trailing edges is 1 microsec. 1 Refs.

Primary Keywords: Capacitor Pulse Generator; Megohm-load Impedance; 20 kV Output; 20-2000 Microsecond Pulse Duration; Rectangular Pulse

COPYRIGHT: 1973 PLENUM PRESS, REPRINTED WITH PERMISSION

420
(PULSE GENERATORS; SWITCHES, CLOSING)

(Review; Thyatrons)

VERY HIGH FREQUENCY PULSE GENERATORS USING HYDROGEN THYRATRONS

B.P. Neuton and G.J. Scales

English Electric Valve Co Ltd, Chelmsford, Essex, UK

IEEE 1973 Eleventh Modulator Symposium pp. 162-166 (09/1973).

Two circuits are described which have been developed to provide high voltage pulses at repetition rates up to 200 kHz. Mention is made of fast recovery hydrogen thyatrons capable of operating in these circuits. 0 Refs.

Primary Keywords: Design Considerations; Thyatron; Very High Rep-rate; Break Modulator; Pulse Transformer

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

421
(POWER CONDITIONING)

(Pulse Forming Lines)

A FAST HIGH VOLTAGE PULSE GENERATOR

J.H. Jack and T. Smith

University of Aberdeen

Journal Of Physics E: Scientific Instruments, Vol. 6, pp 17-19 (01/1973).

This note describes a fast high voltage pulse generator using a thyatron switch and coaxial pulse forming line. It is capable of producing a pulse with an amplitude of up to 4 kV for a duration of 40 ns and is suitable for continuous operation over periods of several hundred hours at a repetition rate of 50 Hz. 12 Refs.

Primary Keywords: Parallel Coaxial Cables; Low Impedance; Fast Rise Time; 4 kV Output Voltage; Thyatron

COPYRIGHT: 1973 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

422
(PULSE GENERATORS)

(Capacitive)

A HIGH-VOLTAGE PULSE GENERATOR FOR SPARK CHAMBERS IN SPACE

A. Baldwin, T. Lund and R. Maday

Kent State University, Kent, OH 44262

Nuclear Instruments And Methods, Vol. 191, No. 2, pp 363-374 (06/1972).

The design and performance characteristics of a high-voltage pulse generator for use with spark chambers in space are described. In order to minimize power consumption, the pulse generator is designed around a cold-cathode thyatron. The complete pulse generator consists of a thyatron pulser and an avalanche-transistor switching circuit. Included also is a simple means for applying a steady clearing field to the spark chambers. The pulse generator can be triggered under uniform repetition rates up to about 100 per second to produce negative pulses with peak amplitudes of typically 2 kV. The observed risetime is about 3 ns with only stray capacitance loading. It increases with the capacitance loading introduced by a spark-chamber at the output of the pulser. The total delay-time from the input trigger pulse to the output pulse is about 14 ns. The pulse decays exponentially with a time constant of the order of a microsecond. Pulse amplitudes up to 4 kV are possible with the particular thyatron selected for this application. 6 Refs.

Primary Keywords: Krytron; Capacitor; Low Energy; Keep Alive

Secondary Keywords: Spark Chamber; Space Application

COPYRIGHT: 1972 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

423
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas; Electrical; Thyatrons; Materials)

DIELLECTRIC INVESTIGATION OF ELECTRIC DISCHARGES IN A MERCURY VAPOUR FILLED THYRATRON

T.K. Bandopadhyay (1) and V.K. Parkya (2)

(1) G.S. Institute of Technology and Science, Indore, India

(2) Holker Science College, Indore, India

International Journal Of Electronics, Vol. 34, No. 2, pp 253-257 (02/1973).

Experiments are presented in which the effect of frequency and discharge current on the real and imaginary components of the dielectric constant of mercury vapor in a thyatron are studied. Frequencies from 5 kHz to 300 kHz were used with discharge currents up to 8 mA. For low discharge currents an area of dispersion of the imaginary portion of the dielectric appears at 120 kHz due probably to a relaxation of the dipoles. 7 Refs.

Primary Keywords: Thyatron; Mercury Vapour; Plasma; Dielectric

Copyright: 1973 TAYLOR & FRANCIS LTD

- 438
(POWER CONDITIONING; PARTICLE BEAMS; ION)
(Systems; Generation)
FORMATION OF COMPLEX MAGNETIC CYCLES IN A 7-GEV PROTON SYNCHROTRON
I.F. Kleopov and G.I. Kyushnev
Institute Of Theoretical And Experimental Physics, Moscow, USSR
Instruments And Experimental Techniques, Vol. 19, No. 1, pp 12-17
(02/1971)
Trans. From: *Pribyor i Tekhnika Eksperimenta* 1, 19-24
(January-February 1971)
The principles of designing universal systems for controlling ignitron converters are described. Systems are designed for successive formation of main magnetic cycles with one or two smooth transitions from positive values of the field derivative $dH/dt = 4$ to 9 kOe/sec to any stipulated value $dH/dt < 0$ (for slow guiding of the beam onto the target), as well as bridging the angular cycles. The duration of a proton beam having an energy of approximately 200 MeV in the interval between the main cycles. The procedure of forming such cycles is demonstrated for operations of the power-supply system of a ring magnet in a mode of 30 cycles/min. 2 Prefs.
Primary Keywords: Ignitron; Semiconductor Switch; Voltage Feedback; dV/dt ; Feedback; Continuous Waveform
COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION
- 446
(PULSE GENERATORS)
(Pulse Forming Lines)
S-DOT-CURRENT-PULSE GENERATOR FOR SUPPLYING SEMICONDUCTOR LASERS
A.I. Andushko
Kazan State University, Kazan, USSR
Instruments And Experimental Techniques, No. 4, pp 1085-1087 (08/1971).
Trans. From: *Pribyor i Tekhnika Eksperimenta* 4, 121-122 (July-August 1971)
The paper describes the circuit of a generator which produces short rectangular current pulses for supplying lasers. The circuit uses the method of shaping powerful current pulses by means of a discharge line. The commutating element of the circuit is a TGS1-10/1 pulse thyatron. The duration of the leading edge of the pulse is 2-3 nsec for a pulse length of approximately 240 nsec. A matching transformer based on cable sections, which allows the voltage to be stepped down and the current to be increased in the load, is used for powerful matching purposes. The current amplitude is equal to 50 A across an equivalent load of 0.2 ohm. 6 Refs.
Primary Keywords: Transmission Line Pulser; Thyatron; Pulse Transformer; Low Voltage; Low Current
COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION
- 445
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Electrical; Thyatrons)
SOME OBSERVATIONS ON ARC POTENTIALS IN HYDROGEN THYRATRON PULSE DISCHARGES
R.J. Armstrong
Auroral Observatory, Troms, Norway
Canadian Journal Of Physics, Vol. 50, No. 12, pp 1337-1345 (08/1972).
Experiments are described in which variations in the arc voltage of high power hydrogen thyatrons due to changes in pulse length, probe voltage, and cathode temperature are examined. Light intensity changes in a long pulse were also noted. The arc voltage was found to be higher when the thyatron was pulsed when a DC voltage was applied. Experimental results were found to agree closely with calculations based on the relaxation properties of charged particles in a plasma. 22 Refs.
Primary Keywords: Arc Potential; High Power; Discharge Relaxation; Hydrogen; Deuterium; Post-pulse Period
COPYRIGHT: 1972 NATIONAL RESEARCH COUNCIL OF CANADA
- 449
(SWITCHES; CLOSING)
(Ignitrons)
2X II 10-MEGAJOULE IGNITRON CROWBAR
F.B. Heady
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 4, pp 322-330 (04/1971).
A 10-MJ Ignitron Crowbar Array for the 2X II fusion machine has been installed, and is now in operation. It is designed to handle about three times the energy of the previous array used with the 2X machine, which has been supplanted by the 2X II. In addition, this array is expected to be considerably more reliable than previous designs. Furthermore, the floor utilization of the assembly is considerably improved, access to all components is better, and the overall cost per kilojoule is substantially reduced. Two insulated identical main pulse coils are incorporated in the 2XII machine. Similarly, the crowbar array is split into two equal parts, with each connected permanently across its pulse coil. 1 Refs.
Primary Keywords: Ignitron; Crowbar; Design Considerations; Pulse Emission
COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION
- 453
(PULSE GENERATORS)
(Capacitive)
A DOUBLE-TUNED CURRENT GENERATOR WITH ELECTRONIC AMPLITUDE CONTROL
L.A. Kaline, P.A. Novysh and T.B. Pavlova
Instruments And Experimental Techniques, Vol. 17, No. 3, pp 742-744 (06/1974).
Trans. From: *Pribyor i Tekhnika Eksperimenta* 3, 104-106 (May-June 1974)
A pulse-current generator (p.c.g.) producing pulses having a length of 120 microseconds and a half-sinusoid shape in an inductive load is discussed. By using 30 V, is described which contains two controlled thyristor switches: one switch in the charging circuit controls the amplitude, while the other in the discharge circuit controls the phase of the current pulse in the load. Special attention is devoted to the linear and nonlinear elements in the power and control circuits of the thyristor columns; these elements ease the dynamic mode of the thyristors. Experimental data are presented for the p.c.g. 14 Refs.
Primary Keywords: Current-pulse Generator; 1250 A Output Current; Half-sinusoid Output; Thyristor
COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION
- 466
(SWITCHES; CLOSING)
(Ignitrons)
ROLE OF SILICON CARBIDE/MERCURY INTERFACE IN IGNITRONS
M.J. Zarebi and M. Satyan
Indian Institute of Science, Bangalore, India
Journal Of Physics D: Applied Physics, Vol. 3, No. 8, pp 1284-1289 (08/1970).
A new model of ignition in an ignitron, based on the electrical breakdown of the junction between the ignitron (semiconductor) and the mercury (metal) is proposed. A method of evaluating some of the ignition characteristics is also developed. The paper gives a critical summary of the various characteristics of the ignition process. The new model is stated and used to explain all the ignition characteristics. The experiments conducted in support of the various aspects of this model are given. 10 Refs.
Primary Keywords: Breakdown Characteristics; Modeling; Ignition Of Discharge; Junction Breakdown
COPYRIGHT: 1970 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 467
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
(Gas; Electrical; Miscellaneous)
SPHERICAL PROBE IN A FLOWING PLASMA
J.G. Andrews and D.T. Swift-Hook
Marchwood Engineering Lab, Southampton, UK
Journal Of Physics A: General Physics, Vol. 4, No. 1, pp 142-157 (01/1971).
Ion flow is important in many laboratory discharges, vacuum switches, gas-filled valves, thyatrons and space satellites. A model is presented for subsonic ion flow past a negative spherical probe immersed in a collisionless ionization-free plasma; a stagnation point develops downstream. Although the floating potential given by previous analyses (which all assume spherical symmetry) is substantially correct, there is some dependence on the ion flow velocity (\sim few eV at $M = 0.5$). Thus the change in floating potential can be used to measure ion flow. In general, only slight modification needs to be made to low pressure probe theories in order to include flow effects. 19 Refs.
Primary Keywords: Subsonic Ion Flow; Spherical Probe; Effect On Flow; Modeling; Potential Measurement
COPYRIGHT: 1971 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 468
(SWITCHES; CLOSING; PULSE GENERATORS)
(Thyatrons; Capacitive)
SQUARE PULSE GENERATOR WITH PULSES OF LARGE AMPLITUDE AND OF VARYING DURATION AND FREQUENCY
D.M. Timush
Institute Of Atomic Physics, Bucharest, Rumania
Instruments And Experimental Techniques, No. 3, pp 811-816 (06/1970).
Trans. From: *Pribyor i Tekhnika Eksperimenta* 3, 156-161 (May-June 1970)
A comparative analysis of series and parallel circuits for connecting thyatrons in pulse generators shows that the parallel circuit has definite advantages. There is a brief description of a generator built on the basis of such a circuit which gives pulses with an amplitude up to 10 kV, a repetition frequency of 3-400 cps, and a duration of 5-300 microseconds. 5 Refs.
Primary Keywords: Thyatron; Series Operation; Parallel Operation; Pulse Shaping
COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION
- 477
(PARTICLE BEAMS)
(Miscellaneous)
ESTIMATES ON THE ACCELERATION OF PELLETS BY GASDYNAMIC AND ELECTROSTATIC MEANS
L.L. Lengvai and W. Riedmuller
Institut fur Plasmaphysik, Garching, FRG
IPP Report No. IPP 4/171 (07/1978).
The authors use mathematical models to estimate the maximum velocity to which a hydrogen pellet could be accelerated. Using gasdynamic drag acceleration the maximum velocity was estimated to be on the order of 100 m/s, while with pneumatic acceleration and electrostatic acceleration velocities on the order of 1000 m/s were estimated to be possible. 29 Refs.
Primary Keywords: Pellet Acceleration; Electrostatic Acceleration; Gasdynamic Acceleration; Pneumatic Acceleration
- 478
(BREAKDOWN STUDIES)
(Gas; Electrical)
EXCITATION OF HIGH-PRESSURE LASER MEDIA BY A DISCHARGE THROUGH AN INSULATOR
V.N. Ishchenko, V.N. Lisitsyn and A.R. Sorokin
Institute of Semiconductor Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Sov. J. Quant. Electron., Vol. 8, No. 4, pp. 453-457 (04/1978).
Trans. From: *Kvantovaya Elektron. (Moscow)* 5, 788-794 (April 1978).
The authors report a scheme to pump high-pressure laser media by a discharge through an insulator. The suitability of several insulation materials is determined using permittivity and electrical breakdown strength of the insulator, and pyroceramic is found to be best for pulsed discharges. It is found experimentally that the E/V of the discharge can be varied over a wide range, which could previously only be done using an e-beam controlled pump. It was found that both carbon dioxide and atomic transition lasers could be pumped efficiently with this method. 10 Refs.
Primary Keywords: Discharge Through An Insulator; Pyroceramic; Glass; Variation Of E/V In Pulsed Discharge
Secondary Keywords: CO₂/sub 2/ Laser; Atomic Transition Laser
COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 483
(PULSE GENERATORS; SWITCHES; CLOSING)
(Capacitive; Thyatrons)
A CERAMIC THYRATRON WIRE SPARK CHAMBER PULSER
B. Friend
CERN, Geneva, Switzerland
Nucleus Instruments And Methods, Vol. 65, No. 3, pp 311-313 (11/1968).
A triggered high voltage pulse generator with 1000 A output capability has been developed for use with wire spark chambers. It has short delay and rise times, a high repetition rate and a long lifetime. 5 Refs.
Primary Keywords: Ceramic Thyatron; Tetrode Thyatron; Coaxial Structure; Fast Rise Time; Low Trigger Power
COPYRIGHT: 1968 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

487
(PULSE GENERATORS; ENERGY STORAGE, INDUCTIVE)
(Systems; Systems)

CONVERTERS FOR SUPPLYING PULSED POWER LOADS

N. Mohan (1) and J.T. Broach (2)
(1) University of Minnesota, Minneapolis, MN
(2) U.S. Amradcom, DAXFB-EA, Fort Belvoir, VA
IEEE Transactions On Industry Applications, Vol. IA-15, No. 1, pp 85-91 (02/1979).

There is a growing need for supplying repetitive pulsed power loads of increasing magnitudes up to several hundred megawatts or more in areas of radar, lasers, high-energy physics experiments and thermonuclear fusion. The nature of such loads can be expected to be as diverse as their applications. The pulsed power demands and corresponding reactive volt-amperes requirements are undesirable from the frequency and voltage fluctuation standpoint, even for the large utility power systems. Techniques for supplying large DC-pulsed loads from a relatively small size AC generator by means of inductive storage and the capacitor-commutated converters are presented. A theoretical basis is provided for analyzing the converters which serve to minimize the effects of pulsed power and correspondingly reactive volt-amperes. Energy transfer between the storage inductor and the pulsed load is permitted with minimal loss, at a readily controllable rate including the reversibility of power in case of inductive loads. Use of a simple control scheme is shown to provide a precise load voltage regulation which may be a requirement for certain applications. The great use of these circuits would be in supplying loads with pulse durations of a few milliseconds to many seconds or minutes. 9 Refs.

Primary Keywords: Pulse Generator; Inductive Energy Storage; Capacitor Commutator; Analysis; Long Pulse; Rep-rated

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

489
(INSULATION, MATERIAL)

(Solid)

SOLID INSULATORS IN VACUUM: A REVIEW

R. Hawley
C.A. Parsons & Co Ltd, Newcastle-upon-Tyne, UK
Vacuum, Vol. 18, No. 7, pp 383-390 (07/1968).

The authors bring together the work of several researchers to present a good review of the behavior of solid insulators in vacuum. The effect of surface angle of declination, electrode and insulator material and surface conditions, length dependence, ambient pressure, coatings, and gap conditioning are all considered with qualitative results presented where available. Several suggestions are made for increasing breakdown strength of solid insulators in vacuum. A qualitative review of breakdown along an insulator in vacuum is presented. 20 Refs.

Primary Keywords: Solid Insulators; Vacuum; Breakdown Phenomena; Prebreakdown Phenomena; Variation of Several Parameters; Increased Dielectric Strength

COPYRIGHT: 1968 PERGAMON PRESS

499
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

TWO-MEGAVOLT DIVIDER FOR PULSED HIGH VOLTAGES IN VACUUM

D.G. Pellingen and M.S. Di Capua
Physics International, San Leandro, CA
Review of Scientific Instruments, Vol. 51, No. 1, pp 70-73 (01/1980).

This paper describes the development of a resistive voltage divider to measure pulsed voltages in excess of 2 MV in vacuo for approximately 100 ns. The monitor can measure either positive or negative polarity by changing the low voltage insulator and reversing the remainder of the insulators and gradient rings. 13 Refs.

Primary Keywords: Megavolt Pulse Divider; Megavolt Vacuum Divider;

High Voltage Pulse Divider; Vacuum Insulation; High Frequency Divider

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

507
(SWITCHES, OPENING)

(Mechanical)

STUDY OF THE EFFECTS OF GAS FLOW ON THE PERFORMANCE OF GAS-BLAST CIRCUIT BREAKERS

H. Koppelin, K. Reiff and K. Zuckler
Siemens AG, Berlin, FRG
Proceedings Of The IEEE, Vol. 59, No. 4, pp 518-524 (04/1971).

Experiments were carried out at a Siemens laboratory with specially designed circuit breakers to investigate the relationship between gas flow and arc behavior for various shapes and arrangements of gas nozzles, as well as for different types of gas and pressure conditions. The current, post-arc current, and voltage measurements were supplemented by the employment of optical methods. By using a high-speed schlieren camera, it was possible to obtain valuable information on the flow characteristics and density of the gas surrounding the arc and to estimate the influence of these quantities on the arc-quenching capacity of a breaker. The interaction of the electric field strength with the arc could also be taken into account by using a dynamic arc model. 17 Refs.

Primary Keywords: Gas-blast Breaker; Gas Flow; Arc Behavior; Current Measurements; Post-arc Current Measurement; Voltage Measurement

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

513
(DIAGNOSTICS AND INSTRUMENTATION)
(Specifications)

HIGH VOLTAGE SPECIFICATIONS AND TESTS (AIRBORNE EQUIPMENT)

M.G. Durbin
Boeing Aerospace Co, Seattle, WA 98124
AFAPL Report No. AFAPL-TR-79-2024 (04/1979).
Availability: AD-A069473
NTIS

Design engineers rely upon system and component standards and specifications as guides for developing electrical equipment. Specifications and standards are available for most low voltage and commercial high voltage equipment, but not for high voltage/high power airborne equipment with ratings exceeding 20 kV and 20 kW. The test and specification criteria (Engineering Criteria Documents) referred to in this paper pertain to high voltage/high power airborne equipment. 0 Refs.

Primary Keywords: Cables; Cable Assemblies; Capacitors; Connectors; High Power; High Voltage; Transformers; Partial Discharge Test Set

Secondary Keywords: Airborne Equipment; Power Characteristics

515
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)

CHARACTERISTICS OF CO-AXIAL MARX GENERATOR AND ITS APPLICATION TO ELECTRON BEAM FUSION

K. Takagi, Y. Kubota and A. Miyahara
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 18, No. 6, pp 1135-1141 (06/1979).

The design of a 720 kV co-axial Marx generator producing a pulse of 40 ns duration with a rise time of 9 ns is presented. The requirements for electron beam fusion and the role of coaxial Marx generators is discussed. Possible applications of the rectangular output pulse produced are examined. 7 Refs.

Primary Keywords: Coaxial Marx Generator; Short Rise Time; Design Considerations

Secondary Keywords: E-beam Fusion

COPYRIGHT: 1979 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

517
(PARTICLE BEAMS, ELECTRON)

(Generation)

COMPACT ELECTRON ACCELERATOR FOR PUMPING GAS LASERS

C.V. Duncan and L.P. Bradley
Lawrence Livermore Lab, Livermore, CA 94555

1976 IEEE Pulsed Power Conference Proceedings, Paper ID-3 (11/1976).

We describe the design and application of a simple e-beam gun for the repetitive pulse pumping of gas lasers. The circuit uses a low inductance Marx and series tuned pulse forming elements.

15 Refs.

Primary Keywords: E-beam Gun; Repetited; Uniform Energy Density; Window Foil Lifetime

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

538
(PARTICLE BEAMS, ION)

(Generation)

MICROSECOND-PULSED ION BEAM FROM A MARX GENERATOR

S. Robertson and M. Wickham
University of California, Irvine, CA 92717

IEEE Transactions on Plasma Science, Vol. PS-7, No. 1, pp 62-64 (03/1979).

We have maintained Langmuir-Child bipolar flow at a peak voltage of 100 kV in a vacuum diode for a microsecond without gap closure or electrical breakdown of the diode electrodes. An ion current of >300 A ($17.5 \text{ A}/\text{sq.cm}$) was extracted from the diode in a beam having a large component of divergence ($10^\circ/\text{rad}^2$). 11 Refs.

Primary Keywords: Vacuum Diode; Langmuir-Child Bipolar Flow;

Microsecond Time Scale

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

540
(PARTICLE BEAMS, ELECTRON)

(Generation)

ON THE DEVELOPMENT OF A REPETITIVELY PULSED ELECTRON BEAM SYSTEM

G.A. Tripathi
Ion Physics Corp, Burlington, MA 01803

2nd IEEE International Pulsed Power Conference Proceedings, pp 214-216 (06/1979).

A pulsed electron beam system—PEBS-III—has been developed at Ion Physics Company to generate an electron beam of 200 keV, $4 \text{ A}/\text{sq.cm.}$, $2.5 \text{ cm} \times 75 \text{ cm}$, 1.3 microsecond, at high repetition rates. The system incorporates a gas-insulated PFN Marx generator in Guillemin C network configuration to drive a cold-cathode electron gun. System performance corresponded to computer simulation of VI waveforms versus generator parameter and impedance-collapse variations. The effort demonstrated the usability of a PFN for energization of long-pulse repetitively pulsed electron guns. 0 Refs.

Primary Keywords: PEBS-III; Marx Generator; Pulse Forming Network; Cold Cathode Diode; Numerical Calculation; Experiment; Long Pulse

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

541
(PARTICLE BEAMS, NEUTRAL)

(Generation)

NUCLEAR POWER APPLICATIONS TO INTENSE NEUTRON SOURCE DEVELOPMENT

J.J. Rodriguez, A.J. Tsoffer and M.J. Cleuser
Sandia Labs, Albuquerque, NM 87185

Nuclear Instruments And Methods, Vol. 165, No. 1, pp 179-183 (08/1972).

The use of conventional and near term pulsed power technology to generate intense fluxes of neutrons for use in fusion reactor materials studies is discussed. Two types of neutron production mechanism are considered. For the immediate future, the use of single pulse or high rep rate intense ion beam sources is proposed to provide high fluxes of neutrons from beam-target interactions. Farther along in time, the use of intense ion or electron beams to initiate inertially confined fusion reactions will lead to intense sources of thermonuclear neutrons. 24 Refs.

Primary Keywords: Neutral Beam; Ion Beam; E-beam; Magnetic Insulation

COPYRIGHT: 1972 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

545
(INSULATION, MATERIAL)

(Solid)

VERSATILE THREE-TERMINAL CELL FOR INVESTIGATING THE ELECTRICAL PROPERTIES OF INSULATING MATERIALS OVER A WIDE FREQUENCY AND TEMPERATURE RANGE

F. Sandrolini
Università di Bologna, Bologna, Italy

Journal of Physics F: Scientific Instruments, Vol. 13, No. 2, pp 152-156 (07/1983).

A three-terminal cell for the measurement of conductivity and dielectric permittivity of insulating materials (chiefly polymers) over a wide range of frequency (DC to 0.6 MHz) and temperature (140 to 400 deg.K) in various environments (from vacuum to some pressure of a desired gas) is described. Heat is transferred by conduction from a cooling/heating unit in contact with the high-voltage electrode. The measuring electrode is insulated by a silica glass washer of very high purity and resistivity. Performances are described and discussed. 19 Refs.

Primary Keywords: Insulation Characterization; Conductivity; Permittivity; Wide Frequency Range; Wide Temperature Range; Design Considerations

COPYRIGHT: 1983 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

546

(POWER CONDITIONING)

(Pulse Transformers; Materials)

FERRITES FOR LINEAR APPLICATIONS I-PROPERTIES

E.C. Snelling

Mullard Research Labs

IEEE Spectrum, Vol. 9, No. 1, pp 42-51 (01/1972).

This two part tutorial article describes properties and applications of magnetically soft ferrites. These materials, which are characterized by high permeability and low losses, are used in very large quantities as cores for inductors and transformers. This first installment provides an elementary introduction to the processes of magnetization in ferrites. It also includes a survey of available grades and a summary of the technical properties of typical modern ferrites. Part II, to appear in February, reviews the main applications, describing how the material properties and performance requirements come together in the design of the device. 16 Refs.

Primary Keywords: Magnetization; Soft Ferrite; Ferrite Grades; Basic Theory; Grain Boundary

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

550

(ENERGY STORAGE; CAPACITIVE; PULSE GENERATORS)

(Marx Generators; Marx)

300-KJ, 200-KA MARX MODULE FOR ANTARES

K.B. Riepe, J. Bickford, J. Jansen and W. Turner

Los Alamos National Labs, Los Alamos, NM 87545

2-IEE International Pulsed Power Conference Proceedings, pp 254-260 (06/1979).

Antares is a 100-kJ CO₂/sub 2/ laser driver for inertial confinement fusion experiments. The power amplification stage is pulsed by an electron-beam-controlled gas discharge. There are 26 annular discharge regions, each requiring energy input of 250 kJ at 550 kV, in a 2-microsecond pulse. The energy storage module chosen for this system is a single-turn pulse-forming network. To provide sufficient energy margin each module stores 300 kJ. A prototype 300-kJ Marx has been built and tested at the Los Alamos Scientific Laboratory. This has been used as a test bed for components, triggering, and instrumentation. 4 Refs.

Primary Keywords: Marx Generator; Design Considerations; Reliability; Life Test; Low Inductance

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

562

(POWER CONDITIONING)

(Pulse Forming Networks)

HIGH-VOLTAGE MICROSECOND PULSE-FORMING NETWORK

K.B. Riepe

Los Alamos National Labs, Los Alamos, NM 87545

The Review Of Scientific Instruments, Vol. 48, No. 8, pp 1028-1030 (08/1977).

A large CO₂/sub 2/ laser being developed at Los Alamos Scientific Laboratory for fusion research requires a high-voltage, high-power pumping pulse of several microseconds duration. A pulse generator has been developed which provides a flat-topped pulse of 120 kA at 300 kV into a matched impedance load, with a 2.5-microsecond pulse duration. The design is based on the use of the Guillumin and Marx circuits. Eight of these will be used to pump an eight-beam laser system. There are applications for this circuit in other fields, such as electron beams for plasma heating. Design techniques for the pulse-forming network are discussed, including physical layout and triggering techniques. 9 Refs.

Primary Keywords: Square Pulse; Marx Generator; Guillumin PFN; Modular Construction; 2.5 Microsecond Pulse Duration; 120 kA Current

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

563

(PARTICLE BEAMS, ELECTRON)

(Generation)

ON THE FORMATION OF PRECISION BEAMS IN MULTISECTION LINEAR ELECTRON ACCELERATORS

V.I. Artemov, I.A. Grishayev, I.M. Gugel', G.K. Dem'yanchenko, N. Devbnya, Y.V. Korniyenko, M.I. Mocheshnikov, F.A. Poyev and V.V. Petrenko

FTD Report No. FTD-ID(RS)T-1919-77 (11/1977).

Trans. From: Ordens Leningra Akademii Nauk USSR Ordens Lineina Fiziko-Tekhnicheskiy Institut, Khfti 71-31, Khar'kov, 1-30 (1971)

Availability: AD-A065859

NRLIS

The authors describe a method of obtaining precision beams from a linear electron accelerator based on the use of communication of radial and phase motion. The effect of high-frequency and current instabilities on the parameters of the beam are investigated. A procedure for measurement of the emittance of the beam at the output of the accelerator is presented. Measurements of beam emittance are shown to 2 GeV. Experimental results are compared with theoretical calculations of the beam parameters. 13 Refs.

Primary Keywords: E-beam; Linear Accelerator; Precision Beam; Instabilities; Emittance Measurement; Experiment; Theory

572

(BREAKDOWN STUDIES)

(Reviews)

OPTICAL DISCHARGES

Yu. P. Raizer

Institute For Problems In Mechanics, Moscow, USSR

Journal De Physique, Vol. 7, No. 40, pp 141-147 (07/1979).

The author discusses the mechanisms involved in discharges initiated by laser radiation. A comparison of optical discharges with discharges of other types is made. The maintenance of equilibrium and non-equilibrium plasma is discussed as is optical discharge propagation. 13 Refs.

Primary Keywords: Optical Discharge; Threshold Field; Non-equilibrium Plasma

COPYRIGHT: 1979 SOCIETE FRANCAISE DE PHYSIQUE

573

(ENERGY STORAGE, INDUCTIVE)

(Systems)

PULSED SUPERCONDUCTING INDUCTIVE STORAGE SYSTEM

O.K. Mavardi and H.K. Chung

Case Western Reserve University, Cleveland, OH 44106

1976 IEEE Pulsed Power Conference Proceedings, Paper IID-5 (11/1976).

A novel pulsed inductive storage system is described. This system is the electromagnetic dual of the Marx generator used extensively in high voltage research. In our scheme a number of superconducting inductors are energized in series and subsequently discharged in parallel. The advantage of our scheme is that it spreads the energy stored over several inductors, reducing the current rating of the switches needed to provide the series-parallel interconnection. Furthermore, it improves appreciably the efficiency of energy transfer from the storage inductor to the load as compared to the efficiency of an inductive system using one storage inductor only. The feasibility of this inductive system is demonstrated on a system consisting of three storage inductors. The inductors are energized by means of flux pump of the Winp design and the switches used are superconducting M-switches (US patent 3,384,767) with a very fast response time. 7 Refs.

Primary Keywords: XPAM; Series Charge; Parallel Discharge; High Efficiency; Flux Pump; M-switch; Inductive Load

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

574

(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

PARMETER ESTIMATION FOR GENERATOR SIMULATION STUDIES

R.P. Webb (1), C.W. Brice (1), D.T. Tan (2) and C.C. Lee (2)

(1) Georgia Institute of Technology, Atlanta, GA 30332

(2) LTV, Baton Rouge, LA 72803

AFAPL Report No. AFAPL-TR-77-69 (11/1977).

Availability: AD-A072006

HTIS

This report presents a detailed study of alternator parameter estimation procedures, including comparison of theoretical results to test data and to simulation results. 36 Refs.

Primary Keywords: Generator Modeling; Sensitivity Analysis; Parameter Identification; Simulation

579

(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(LC; LC Generators)

15-KJ LC GENERATOR: LOW INDUCTANCE DEVICE FOR A 100-GW PULSED ELECTRON ACCELERATOR

N.W. Morris (1) and H.I. Milde (2)

(1) Naval Research Lab, Washington, DC 20375

(2) Ion Physics Corp, Burlington, MA 01803

Journal Of Vacuum Science Technology, Vol. 12, No. 6, pp 1188-1190 (12/1975).

In this paper the author describes an L-C generator used to charge a pulse forming line in an e-beam generator. The L-C generator is both more efficient and allows shorter pulses than a Marx driven system. This is due to the fact that the intermediate store is eliminated. Switching inductance and rise time are considered. 3 Refs.

Primary Keywords: L-C Generator; Water Line Pulse Charging; Pulse Forming Line

Secondary Keywords: E-beam Generation

COPYRIGHT: 1975 AMERICAN VACUUM SOCIETY

580

(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

PROGRAM FOR THE DEVELOPMENT OF A SUPERCONDUCTING GENERATOR

J.L. McCabe (1)

Westinghouse Electric Corp, Lima, OH 45802

AFAPL Report No. AFAPL-TR-79-2012 (02/1979).

Availability: AD-A072093

HTIS

This report summarizes work completed in Phase II and Phase III of a program for the development of a superconducting generator. A 5-MW, 400 Hz, 12000 rpm generator was designed and built during Phase II. The oil cooled stator contained a 3-phase, wye connected, 5 kV, flooded winding within a laminated iron shield. The rotor contained a winding of 0.09 cm x 0.14 cm wire with 438 36 micron filaments of Nb-Ti superconducting alloy. A rotating dewar with a cold electrical thermal shield was used. The Phase III work consisted of a warm shunt of the generator to design speed followed by cool-downs of the rotor. A superconducting air gap was used in the generator configuration due to high pressure in the vacuum space which resulted in excessive gas conduction into the field winding compartment. A continuous pump-down system was incorporated into the test set-up but the helium leakage rate exceeded the capability of this system.

Further work is required to correct this problem. 23 Refs.

Primary Keywords: Superconductors; Cryogenics; Helium; Light Weight;

Secondary Keywords: Generators

589

(PARTICLE BEAMS, ELECTRON)

(Generation)

HARP: A SHORT PULSE, HIGH CURRENT ELECTRON BEAM ACCELERATOR

K.R. Prestwich

Sandia Labs, Albuquerque, NM 87115

IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 975-978 (06/1975).

A 3 MV, 800 kA, 24 ns electron beam accelerator is described and the results of initial switching experiments are discussed. The generator will provide a source for studying the physics of processes leading to electron beam driven, inertially confined fusion. The major components of the accelerator are two diodes with a common anode, twelve oil-dielectric Blumleins with low jitter (<2 ns) multichannel switches, three intermediate storage capacitors, a trigger pulse generator, and a gas gun. 6 Refs.

Primary Keywords: Field Emission Diode; Oil Blumlein Line; Oil Rail Gap; Multichannel Spark Gap

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

12

595
(PULSE GENERATORS; PARTICLE BEAMS, ION)
(Systems; Generation)

MAGNETICALLY INSULATED LINAC DRIVEN BY A MULTISTAGE MARX GENERATOR
F. Winterberg
University of Nevada System, Reno, NV 89507

Zeitschrift für Physik A, Vol. 280, No. 4, pp 359-362 (01/1977).

A method of accelerating intense ion beams so that the ions have an energy of about 5 GeV using a multistage Marx generator to drive a magnetically insulated linear accelerator is presented. This proposed scheme allows the accelerator to be much shorter than conventional setups using microwave driven linacs. With proper scaling of the original plan, beam powers up to 500 TW should be attainable. 11 Refs.

Primary Keywords: Marx Generator; Magnetic Insulation; Heavy Ion Beam; Multi-Gev Energy; Very High Current

Secondary Keywords: E-beam Fusion

COPYRIGHT: 1977 SPRINGER-VERLAG

597
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Marx; Marx Generators)

OVERTOWLAGE AND BREAKDOWN PATTERNS OF FAST MARX GENERATORS

R.W. Morrison and A.M. Smith

Carleton University, Ottawa, Ontario, Canada

IEEE Transactions On Nuclear Science, Vol. NS-19, No. 4, pp 20-31 (08/1972).

Spark gap overvoltages of fast Marx generators in the 100-300 kV range were studied as a function of stray and interstage capacitance for several circuit designs. Overvoltage measurements were made at low voltages by simulating the spark with a silicon-controlled rectifier. Breakdown times were measured to nanoseconds by viewing the light flash from the sparks with a fast photomultiplier. The influence of the ultraviolet irradiation on breakdown time was studied by masking the first gap. Practical conclusions for Marx generator design are presented. 10 Refs.

Primary Keywords: Marx Erection Time; Gap Overvoltage; Stray Capacitance; Interstage Capacitance; Thyristor Simulation; Analysis

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

602
(SWITCHES, CLOSING)

(Ignitrons)

REVERSE CURRENT AND ARC-BACK IN A SINGLE-GAP MERCURY-ARC VALVE

C.E. Fernando

Central Electricity Generating Board, London, UK

Proceedings Of The IEEE, Vol. 59, No. 4, pp 536-538 (04/1971).

Arc-backs produced by continuously raising the stress on a high-voltage single-gap single-anode mercury-arc valve are preceded by a change in reverse current before failure occurs. On the cycle at which arc-back occurs the reverse current rises rapidly to about 10 A at peak reverse voltage (140 kV maximum). Subsequently, the reverse current decreases and then rises again steadily for several hundred microseconds. Failure occurs during this second rise of current. These changes in reverse current prior to arc-back are reproducible. The current values observed on the cycle at which arc-back sets in is also reproducible (the 10 percent variation of arc-back is interpreted as a sequential process that is initiated by ignition, at peak voltage, of a stable high-voltage discharge in the valve). The subsequent rise of reverse current which leads to failure is attributed to a rise in gas pressure within the valve due to ion bombardment from the high-voltage discharge. The measured delay of 60 microseconds from the point or rapid rise in reverse current to the start of the final growth of current suggests that mercury vapor is evolved from the negatively biased main anode to cause a rise in gas pressure. Detection of precursor currents might allow suspect valves to be blocked in time to prevent the occurrence of a full arc-back. 23 Refs.

Primary Keywords: Arc-back Mechanism; Power Frequency; Device Failure Modes

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

605
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)

(Generation; Marx)

A NEW METHOD OF EXCITING UNIFORM DISCHARGES FOR HIGH PRESSURE LASERS

R.W. Morrison and C. Swail

Carleton University, Ottawa, Ontario, Canada

Physics Letters, Vol. 40A, No. 5, pp 375-377 (08/1972).

A Marx generator producing 500 kV pulses lasting 20 ns is used to create a uniform discharge by field emission from a stainless steel wire cathode in a TEA carbon dioxide laser. Variations in peak power, delay time, and pulse width with nominal Marx voltage are given. 5 Refs.

Primary Keywords: Field Emission Large Area Diode; Marx Generator; Townsend Avalanche; Space Charge Limited

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1972 NORTH-HOLLAND PUBLISHING CO.

606
(PULSE GENERATORS; SWITCHES, CLOSING)

(Systems; Gas Gaps, Electrical)

A SIMPLE SYSTEM PRODUCING A 450 KV PULSE WITH 1 NS RISE TIME

K. Eggert

Physikalischches Institut, Technische Hochschule Aachen, Aachen, FRG

Nuclear Instruments And Methods, Vol. 106, No. 3, pp 509-512 (03/1973).

A simple pulse shaping network is described. It consists of a capacitor connected in series with a sparkgap. A Marx generator feeds the system. Calculations of the equivalent circuit reproduce the behaviour of the pulseformer, which generates a pulse of 450 kV with 1 ns rise time and 10 ns fall on a load of 80 ohm. With such a system streamer chambers can be driven quite conveniently. 1 Refs.

Primary Keywords: Marx Generator; Pulse Generator; Intermediate Storage

Capacitor; Rise Time Reduction

COPYRIGHT: 1973 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

611
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Marx; Marx Generators)

COMPACT, ULTRA-HIGH DENSITY MARX GENERATOR

D.M. Strickland and W.L. Heatherly

AFCRL, Kirtland AFB, NM 87117

IEEE 1973 Eleventh Modulator Symposium pp. 113-120 (09/1973).

This report presents the results of an Air Force Weapons Laboratory project to develop a compact, high-density energy storage system for ultra-high voltage electrical simulation applications. Requirements, such as currents ranging from small, 1-MV ground-based simulators to elevated or air-supported simulators producing tens of megavolts, based on studies performed during the High Altitude Simulation program and reported in the EMP-HAS report series, it was concluded that the most versatile and promising pulse generator system for matching this broad range of requirements would utilize a Marx generator and a dielectrically isolated switching network circuit. 5 Refs.

Primary Keywords: Marx Generator; Pulse Generator; Parallel Diode; Pulse Generator

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

613

HIGH-VOLTAGE TECHNOLOGY FOR THE LASL IMPLOSION-HEATING EXPERIMENT

J.E. Hammel, J. Hawkins, J. Marshall and A.R. Sherwood

Los Alamos National Lab., Los Alamos, NM 87545

No. CONF-73114-3B, 4p (01/1973).

Availability: LA-UR-73-1753

HTIS

For abstract, see HSA 29 06, number 14440.

Primary Keywords: Pulse Generators; Specifications; Toroidal Theta Pinch Devices; Plasma Heating; Electronic Equipment; Implosions

Secondary Keywords: AEC

615

(SWITCHES, CLOSING)

(Gas Gaps, Optical)

PRECISE LASER INITIATED CLOSURE OF MULTIMEGAVOLT SPARK GAPS

J. Maruyama (1), H. Milde (1), J.R. Bettis (2) and A.H. Guenther (2)

(1) Inn. Physics Corp., Burlington, MA 01803

(2) AFWL, Kirtland AFB, NM 87117

The Review Of Scientific Instruments, Vol. 42, No. 12, pp 1767-1776 (12/1971).

Single and double-channel laser triggered switches in high pressure gas have been designed and operated in the voltage range from 1 to more than 3 MV. Jitter times of <1 to 5 nsec were observed in most cases. Gas pressures of 10.5 and 21 kPa/cm² were used. The gases were either 100% nitrogen or various mixtures of N₂/SF₆/Ar, 67, and Ar. Significant accomplishments were (1) the simultaneous firing of four stages of a Marx generator by an optically divided laser beam, (2) up to 40% reduction in the rise time observed in the output pulse from a multimegavolt DC generator when switched into a load through two simultaneously laser triggered channels, and (3) the development of a laser triggered, DC charged switch at more than 3 MV. 23 Refs.

Primary Keywords: Laser-triggered Spark Gap; Single Spark Channel; Double Spark Channel; Ruby Laser; Various Gases; High Pressure; Marx Generator

COPYRIGHT: 1971 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

616

(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)

(Generation; Transport)

PRODUCTION AND DYNAMICS OF HIGH INTENSITY ELECTRON BEAMS

G. Brautigam (1), I. Boscojo (2), R. Colisson (2), M. Leo (2), A. Luches (2) and A. Tepore (2)

(1) Universita Di Bari, Bari, Italy

(2) Universita Di Lecce, Lecce, Italy

IEEE Transactions On Nuclear Science, Vol. NS-20, No. 3, pp 286-288 (06/1973).

High intensity electron beam experiments are in progress at electron energies varying from 100 keV to 2 MeV. The low energy machines are Marx generators, while the high energy one is an electron beam transformer accelerated by a homopolar some original technical solution. Its electron energy is 2 MeV, current >10 kA, pulse length 20 ns at a repetition rate of 10 pps. The purpose is injection in the ANEL-type electron ring accelerators, beam dynamics and plasma-beam interaction investigations. Several models of field emission diodes have been investigated by various diagnostic methods and beam pictures on various materials have been taken. 3 Refs.

Primary Keywords: ANEL; Field Emission Diode; Magnetic Field; Bunching

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

619

(PULSE GENERATORS)

(Marx)

PULSE GENERATORS AND MODULATORS FOR LASER APPLICATIONS

L.M. McClusky, E.L. Roy, W.H. Gurley, C.M. Boudin, A.H. Werkheiser and C. Casan

Army Missile Command, Redstone Arsenal, AL 35809

IEEE 1973 Eleventh Modulator Symposium pp. 121-128 (09/1973).

A high voltage pulse generator has been constructed for laboratory use in powering a high average power pulse laser. The pulse generator has three 500 kVA power transformers, a 3-phase rectifier and four mechanically synchronized 5-stage Marx generators. At 70 kV charge voltage 7350 J are stored. Instabilities in the laser load are observed at approximately 70 kV charge. Very satisfactory 4 second operations of the pulse generator have been achieved at a PRF of 50 pps which corresponds to an average output power of 280 kW at 300 kV peak. 0 Refs.

Primary Keywords: Marx Generator; High Rep-rate; Design Considerations; Mechanical Synchronization; Variable Pulse Width

Secondary Keywords: laser load

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

620

(ENERGY CONVERSION, ELECTRICAL)

(Charging Circuits)

STREAMER CHAMBER CHARGING REGULATOR SYSTEM

R.E. Fuhr and J. Dewey

Argonne National Lab., Argonne, IL

Nucleonics Instruments And Methods, Vol. 100, No. 2, pp 329-331 (04/1972).

In a streamer chamber system being built at Argonne National Laboratory, the specifications for pulse repeatability impose stringent requirements on the Marx generator charging electronics. A charging regulator using type 285 tetrode modulator tubes was developed to provide the required stability. The system philosophy, design requirements, and circuit configuration are discussed. 2 Refs.

Primary Keywords: Marx Generator; Blueline Line; 0.1 Percent Repeatability; Series Regulator

COPYRIGHT: 1972 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

621

(PULSE GENERATORS)

(Marx)

THE GENERATION OF LIGHTNING AND SWITCHING IMPULSE VOLTAGES IN THE UHV REGION WITH AN IMPROVED MARX CIRCUIT

A. Rodewald and K. Feser

Haeferl Ltd., Basel, Switzerland

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-93, No. 1, pp 414-420 (07/1974).

This paper concerns the trigger performance of Marx circuits and shows the essential features of an improved circuit. It is studied how the introduction of parallel spark gaps PF and firing capacitors C_f in a multi-stage impulse generator can improve the trigger performance. Other advantages of the new circuit will also be discussed. 15 Refs.

Primary Keywords: Marx Generator; Trigger Performance; Design Considerations; Principles Of Operation; Square-wave Gap; Improved Circuit; Parallel Spark Gap

COPYRIGHT: 1974 IEEE, REPRINTED WITH PERMISSION

622
(PARTICLE BEAMS, ELECTRON)
(Generation)

THE HYDRA ELECTRON BEAM GENERATOR

T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 3, pp 289-293
(06/1973).

The Hydra electron beam generator was designed to simultaneously produce two 1 MV, 0.5 MA, 80 nanosecond electron beams that could be combined to form a single beam. The machine, undergoing final developmental tests, has generated a 0.5 MA, 1 MV peak electron beam from each line. This accelerator consists of a low-inductance Marx generator, two water-dielectric pulseforming (PF) and impedance-transforming transmission lines and two low-inductance, high-current diodes. A description of the generator is presented along with developmental studies and initial testing data. The Hydra machine is based on accelerator principles described in the literature. The Marx generator is submerged in transformer oil and separated from the transmission lines by a lucite interface. The Marx charges each coaxial PF transmission line which is insulated by deionized water to 3 MV in 0.9 microseconds. At peak voltage a 3 MV SF₆/SF₆ spark gap electrically connects the 4 ohm PF line to the impedance transforming (4 ohm to 2 ohm) transmission line. The pulse is transmitted through this line to the single radial insulator diode. A 30 kilogaule, 100 nanosecond duration electron beam is formed by a cold cathode in each diode. 12 Refs.

Primary Keywords: Marx Generator; Pulse Forming Line; Impedance Matching; Field Emission Diode; Design Considerations

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

624
(SWITCHES, CLOSING)

(Solid Dielectric, Optical)

LASER TRIGGERED SOLID DIELECTRIC SWITCHING

M. Ury, D. Mory and M. Friedman
Cornell University, Ithaca, NY 14850
IEEE Transactions On Nuclear Science, Vol. NS-18, pp 314-321 (01/1971).
A Q-switched ruby laser was used to initiate breakdown in solid dielectric switches with a jitter of less than 3 ns. Polycarbonate in thickness from 40 to 80 mils withstood applied voltage pulses (less than 1 microsecond duration) of up to 900 kV. Laser pulse energy of less than 1 joule was sufficient to initiate breakdown in the solid dielectric. A focusing lens and the switch container were immersed in a grading solution of copper sulfate and water. Command triggering down to 50% of the dielectric's self breakdown voltage was demonstrated. A test system employing a miniature Marx generator, and a high energy system switching 150 kA at 400 kV to form precisely time relativistic electron beams, are described. 5 Refs.

Primary Keywords: Ruby Laser; Polycarbonate Dielectric; Low Energy Laser; Wide Voltage Range; Sphere-plane Gap

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

625
(BREAKDOWN STUDIES)

(Gas, Optical)

OBSERVATION OF HIGHLY IONISED SPECIES IN PLASMA PRODUCED BY PICOSECOND LASER PULSES

R.J. Dewhurst, C.J. Part and S.A. Ramadhan
University of Hull, Hull, UK
Optics Communications, Vol. 9, No. 3, pp 287-290 (11/1973).
Results are presented of an experiment to measure the breakdown of a solid target by laser radiation in a vacuum. The laser used was a mode-locked Nd-glass ring laser. This laser was used to irradiate PTFE, carbon, and aluminum targets. Spectra were taken using a normal incidence spectrometer having a resolution of about 0.5 angstroms, plots are shown of PTFE and aluminum spectra. 11 Refs.

Primary Keywords: Nd-glass Laser; PTFE Target; Aluminum Target; Normal Incidence Spectrometer

COPYRIGHT: 1973 NORTH-HOLLAND PUBLISHING CO.

626
(PARTICLE BEAMS, ELECTRON)

(Generation)

HERCUS, A 250 KV, 80 KA ELECTRON BEAM GENERATOR

K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 493-495
(03/1971).
A 250 - 400 KV, 80 KA, 30 ns electron beam generator has been developed. The machine consists of a 400 KV Marx generator, a water-dielectric transmission line, a diode, and a beam drift chamber. It was necessary to minimize repulsion for stable diode operation. Several cathodes were tested during development and results are reported. Diodes with 26 and 8 mH inductance are described. 4 Refs.

Primary Keywords: Field Emission Diode; Drift Tube; Marx Generator; Water-dielectric Transmission Line; Several Cathode Materials

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

628

(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Marx; Marx Generators)

DEVELOPMENT OF AN 18-MEGAVOLT MARX GENERATOR

K.R. Prestwich and D.L. Johnson
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-16, No. 3, pp 64-69
(06/1971).

An 18-megavolt, 1 megajoule Marx generator has been constructed and tested to 11 MV as the primary energy store of the Hermes II flash x-ray machine. A geometrical arrangement for the capacitors that takes advantage of the stray capacitances to provide a wide triggering range and fast Marx erection time was developed from model and circuit studies. The design parameters of the Marx were checked by constructing and testing a 4 MV, 100 kJ generator using components proposed for the 18 MV system. Spark gaps were developed specifically for the generator and have operated successfully for over 50,000 gap firings. 6 Refs.

Primary Keywords: 1 MJ Energy; Hermes II; Stray Capacitance; Reliable Triggering; Fast Rise Time; Good Reliability

COPYRIGHT: 1969 IEEE. REPRINTED WITH PERMISSION

630
(PARTICLE BEAMS, ELECTRON)
(Generation)

A STUDY OF THE DOUBLE-FOCUSING DIODE

K. Takagi
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 18, No. 12, pp 2255-2262
(12/1979).

Double-focusing diode characteristics are investigated with special emphasis placed on impedance and anode plasma density. A co-axial Marx generator was used to supply a rectangular pulse across a constant load. Two different types of anodes were used on the double-focusing diodes. One was a mesh anode with 75% transparency and the other was a range-thick carbon plate with a 6 mm hole in its center. The double-focusing diodes were found to have a reduced impedance and a denser anode plasma than single diodes. 17 Refs.

Primary Keywords: Double-focusing Diode; Co-axial Marx Generator;

Impedance Reduction; Very Low Impedance; Electron Reflexing

COPYRIGHT: 1979 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

632
(PULSE GENERATORS)

(Systems)

DISTRIBUTED PARAMETER MODEL OF THE TRESTLE PULSER

T.H. Lohman, R.L. Hutchins and R. Fisher
EDM Corp, Albuquerque, NM 87106
2nd IEEE International Pulsed Power Conference Proceedings, pp 425-428
(06/1979).

A distributed parameter circuit analog model was developed to evaluate design improvements for the TRESTLE pulser. The approach for specifying the model network and estimating model parameters is given. Model results are shown to compare favorably to available measurements. The model's flexibility and economy allowed ready evaluation of potential modifications. 3 Refs.

Primary Keywords: Marx Generator; Peaking Capacitor; Analysis;

Secondary Keywords: Modeling

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

635
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Marx; Marx Generators)

LOW-IMPEDANCE, COAXIAL-TYPE MARX GENERATOR WITH A QUASI-RECTANGULAR OUTPUT WAVEFORM

M. Obera, Y. Sakata, C.H. Lee, T. Hashimoto and T. Fujioka
Keio University, Kohoku-ku, Yokohama-shi, Japan
2nd IEEE International Pulsed Power Conference Proceedings, pp 165-171
(06/1979).

Theoretical analysis of a low-impedance, coaxial type Marx generator, in terms of the equivalent electrical circuit, can offer the most appropriate parameters for the design of a Marx generator to produce a quasi-rectangular output waveform. The results of this theoretical analysis can be conveniently aligned to the design of various types of coaxial Marx generator. Based upon theoretical analysis, three Marx generators of 0.6MV, 1.0MV, and 2.6MV have been developed for the e-beam initiation of an HF chemical laser. The results of the analysis were in good agreement with the experimental results. They have a completely coaxial configuration. One advantage of these machines is that they can directly drive a low-impedance electron-beam diode, without a low-impedance PFN, for the efficient production of an intense relativistic electron beam. They are also remarkably compact. 16 Refs.

Primary Keywords: Coaxial Marx Generator; Low-impedance; Quasi-rectangular Output; Theory; Experiment

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

638
(PULSE GENERATORS)

(Systems)

THE DESIGN APPROACH TO A HIGH-VOLTAGE BURST GENERATOR

D. Cummings and H.G. Hammon III
Physic International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 172-178
(06/1979).

An increasing number of experimental programs call for a sequence of several closely spaced, high-voltage pulses. This paper presents the various design considerations for such a system. These include the kind of pulse generator, series or parallel configuration, kinds of lines, aspect ratio, choices of dielectric, switch type, triggering considerations, Marx Generator design and isolation, feed problems, pulse formation, and waveform degradation with increasing stages. The design procedure is illustrated by the M-2 pulser built for the PHERMEX Facility at the Los Alamos Scientific Laboratory. This system produces a train of up to three 40 ns pulses, variable from 600 kV to 1.4 MV with pulse separations of 100 ns to 1 ms. Results are given and waveforms presented. 0 Refs.

Primary Keywords: Burst Mode; Design Considerations; PHERMEX; Experimental Marx Generator; Pulse Line

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

651

(PULSE GENERATORS)

(Stacked Line)

A COMPACT POWERFUL-PULSE GENERATOR

Y. Carmel, S. Eylon and E. Shohet
Government Of Israel Scientific Department, Tel-Aviv, Israel
Journal Of Physics E; Scientific Instruments, Vol. 11, No. 8 pp 748-750
(08/1978).

6 Refs.

Primary Keywords: Stacked Line Transformer; Coaxial Marx Circuit; 25ns, 1000kV Pulses

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

642

(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)

(Marx Generators; Marx)

A LOW INDUCTANCE, COMPACT, 1 MV, 10 KJ MARX GENERATOR

R.D. Stine, Jr.
Manwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-2 (11/1976).

The electrical characteristics and design features of a low inductance, compact, 1 MV, 10 kJ Marx generator are discussed. Generators with a wide range of output energies are easily obtained by series/parallel configurations of components. A precision triggered, three-electrode, 100 KV switch and the compact physical arrangement of plastic-cased capacitors results in less than 100 nH inductance per stage in the Marx. Reliable operation over a three to one voltage range is readily achieved by varying the spark-gap gas pressure. 3 Refs.

Primary Keywords: Marx Generator; Low Inductance; Compact Size; Modular Design

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

643
(POWER CONDITIONING)
(Pulse Transformers)

A REPETITIVE 600 KV STACKED LINE TRANSFORMER PULSE GENERATOR
Y. Cariel, E. Shavit
Israel Scientific Dept., Tel-Aviv, Israel
Journal of Physics E: Scientific Instruments, Vol. 11, pp 748-751
(08/1978).

A novel approach is described for the design of high-voltage fast pulse generators. It is based on a combination of a stacked line transformer (SLT) and a coaxial Marx circuit, whose principles were successfully applied for the design of a 600 kV, 25 ns repetitively pulsed generator. 1 Refs.

Primary Keywords: Stacked Line Transformer; Coaxial Transmission Line; Marx Generator; Fast Rise Time

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

649
(PULSE GENERATORS)

(Systems)
HIGH VOLTAGE NANoseconds PULSE GENERATOR WITH VERY FAST RISE TIME
Y. Kubota and A. Miyahara
Nagoya University, Nagoya, Japan
Japanese Journal of Applied Physics, Vol. 17, No. 10, pp 1907-1908
(05/1978).

A description is given of a pulse generator producing a 300 kV, 5 ns pulse into a 5 ohm matching load with a rise time of 5 ns. A 720 kV Marx generator is incidently charged and then discharged through multichannel spark gaps providing the power for the pulse. 2 Refs.

Primary Keywords: Marx Generator; Water Line; Self-break Water Switch; Sub-nanosecond Rise Time

Secondary Keywords: E-beam Fusion

COPYRIGHT: 1978 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

650
(POWER CONDITIONING)
(Voltage Regulation)

HIGH-POWER PULSE GENERATION

R. Arockiasamy and K. Kanti
Indian Institute of Technology, New Delhi-110029, India
Proceedings Of The IEEE, August 1977, pp 1209-1210 (08/1977).

A trigger circuit for generating high-power pulses directly from the power frequency supply is described. The circuit has a wide scope of application in industry and research. Typical applications are mentioned. 3 Refs.

Primary Keywords: SCR Power Conditioning; Power Control; Regulation; SCR Power Control; Poly Phase SCR Control; Power Rectifier

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

653
(BREAKDOWN STUDIES)
(Exploding Wires)

MULTIPLE-WIRE ARRAY LOAD FOR HIGH-POWER PULSED GENERATORS

C. Stallings, K. Nielsen and R. Schneider

Applied Physics Letters, Vol. 29, No. 7, pp 404-406 (10/1976).

Exploding wire loads have been used for several years to generate a hot dense plasma. For a generator with a rise time of tens of nanoseconds and an impedance of 1 ohm or less, the inductance of the wire load and the tendency of current to flow outside the wire limits the energy that can be transferred to the wire. An array of several wires has now been used to lower the inductance and improve the energy transfer. 8 Refs.

Primary Keywords: Exploding Wires; Multiple-wire Array; 1 MA Current; Current Measurement; Impedance Matching

Secondary Keywords: Plasma Generation

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

656
(SWITCHES; CLOSING)
(Gas Gaps; Optical)

THE LASER TRIGGERING OF HIGH-VOLTAGE SWITCHES

A.H. Guenther and J.R. Bettis

AFWL, Kirtland AFB, NM 87117

Journal of Physics D: Applied Physics, Vol. 11, pp 1577-1613 (02/1978).
The laser-triggered switching (LTS) of high-voltage spark gaps is considered. The basic theory is presented which predicts dependencies of the delay to breakdown and switching jitter on such variables as fill gas mixture and pressure, gap spacing, polarity, and geometry. It is shown that electrical arcs of several metres length can be directed by laser action. A complete set of experiments is reported which adequately support the proposed theory. The performance of LTS is considered and results are reported on multiple-gap triggering and multigap triggering. Triggering of voltages in excess of 3 MV by repetitive switching at rates up to 50 pps with subnanosecond jitter as well as various geometries, pulse forming demonstrations, and output voltage selection on a Marx generator. Solid, liquid, and vacuum insulation mediums are also discussed and experimental results reported. Finally, numerous applications of LTS are presented as well as a list of recommended operating characteristics to obtain optimum switching performance. 126 Refs.

Primary Keywords: Laser-triggered Spark Gap; Switch Delay; Jitter; Variable Pressure; Variable Gas Mixture; Variable Gap Spacing; Discharge Guiding; Experiment; Theory

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

658

(PULSE GENERATORS)

(Line Type)

WAVE PROCESSES IN HIGH-POWER NANosecond PULSE GENERATORS

Yu.P. Kubr'kov

M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 4, pp 515-516 (04/1976).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 889-890 (April 1976).
The use of pulse forming lines in the production of electron beams is widespread today. As a result, it is necessary to characterize these lines by their pulse-forming characteristics. The solution proposed here is based on the principle of the superposition of the incident and reflected waves; the system is partitioned into several regions, which are treated as four-poles, whose parameters are governed by the design. Then, for the case in which reflected and incident waves are present, a solution is found in terms of the known reflection and refraction coefficients. To carry out calculations for a system consisting of coaxial lines, it is sufficient to determine the amplitudes of the waves propagating in the forward and reverse directions in all regions. The number of these regions depends on the properties of the dielectric medium, the propagation velocity of the electromagnetic waves, the length of the system, and the time step of the calculation. After determining these initial values for the forward and reverse waves throughout the system for a given time, we can determine the wave incident on the switches and the load. 3 Refs.

Primary Keywords: Pulse Forming Line; Design Considerations; Switching

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

671

(PULSE GENERATORS; SWITCHES; CLOSING)

(Capacitive; Thyristors)

A FLEXIBLE HIGH POWER PULSE GENERATOR USING THYRISTORS

D.F. Gibbs

H.W. Wills Physics Lab, Royal Fort, UK

Journal of Physics E: Scientific Instruments, Vol. 4, pp 1065-1066
(12/1971).

A simple pulse generator is described which in conjunction with low voltage triggering equipment is capable of delivering pulses of up to 250 V into open circuit with a source impedance of less than 1 kohm. Pulse width is variable from about 1 microsec upwards. No difficulty is anticipated in producing higher voltages and currents if required. 0 Refs.

Primary Keywords: Pulse Generator; Variable Pulse Width; Thyristor

Switch; 250 V Output

COPYRIGHT: 1971 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

675

(PULSE GENERATORS; POWER CONDITIONING)

(Marx; Pulse Forming Lines)

HIGH-POWER CURRENT PULSE GENERATOR

O.G. Zagorechnov, L.I. Boletin, I.I. Magda, N.P. Gadetskii, V.I. Belysev
and Yu.V. Tkach

Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR,
Kharkov, USSR

Instruments And Experimental Techniques, No. 5, pp 1359-1361 (10/1970).

Trans. From: Poiskovye Tekhnika Ekspertizy 5, 100-102
(September--October 1970).

A generator of high-current current pulses, 30 nsec wide, with the electron beam current reaching 12 kA at 500 kV is described. The generator consists of two forming lines with distilled water used as the dielectric and an electron gun with a multipointed cathode. The line is charged from a voltage pulse generator using the Arkad'ev-Marx circuit. Because water is used as the dielectric, the capacitance of the line is approximately 10 nF for relatively small dimensions, which allows approximately 0.5 kJ to be stored and approximately 1E9 W to be discharged into the load. 5 Refs.

Primary Keywords: Marx Generator; Pulse Forming Line; Double Forming Line; Low Impedance; Water Dielectric; 500 kV

Operating Voltage

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

681

(PULSE GENERATORS; SWITCHES; CLOSING)

(Line Type; RBDT)

AN ALL SOLID-STATE MODULATOR FOR THE ARSR-3 TRANSMITTER

E.H. Hooper and S.R. Bird

Westinghouse Electric Corp, Baltimore, MD 21203

IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1496-1499
(10/1979).

This paper describes an all solid-state, high-power pulse modulator used in the ARSR-3 system (an FAA air route surveillance radar system). The modulator, the culmination of a number of years of both design and circuit development, uses fast switching Reverse Blocking Diode Thyristors (RBDT's) to directly switch 14-MW, 3 microsecond video pulses at high current without the use of magnetic switching aids. The modulator consists of five identical PFM modules, a trigger amplifier, and a pulse transformer which matches the modulator output to the beam characteristics of a klystron. Each module contains its own PFM, discharge RBDT switch assembly, and associated circuitry. This modulator is the first production equipment to use the new Westinghouse T62R RBDT devices. The devices switch 2200 A pulses with a turn-on rate of rise of up to 300 A/microsecond. 3 Refs.

Primary Keywords: Pulse Forming Network; Reverse Blocking Diode Thyristor; Modular Design; Performance Test

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

684

(BREAKDOWN STUDIES)

(Lightning)

SURVEY ON ACTUAL KNOWLEDGE AND PHYSICAL PROBLEMS

K. Berger

51 Ostdistrasse, CH 8702, Switzerland

Journal De Physique, Vol. 40 No. 7 pp. 57-62 (07/1979).

An overview of recent lightning research is presented. Also discussed are three physical problems of lightning discharges: the problem of stepped leaders, of the velocity of leaders and return strokes, and of the current rise in the first and subsequent strokes. 0 Refs.

Primary Keywords: Lightning Initiation; Charge Cells; Positive

Particle Migration; Upward Leader; Downward Leader

COPYRIGHT: 1979 SOCIETE FRANCAISE DE PHYSIQUE

686
(REVIEWS AND CONFERENCES)
(Reviews)

LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY
W.J. Sargeant (Ed.)
Los Alamos National Labs, Los Alamos, NM 87545
Collection Of Lectures (10/1980).

Availability:

See Individual Lectures.

Thirteen lectures given at the University of New Mexico and Los Alamos Scientific Laboratory concerning pulse power. Topics discussed include energy storage; switching; power conditioning; and particle beam generation. Twelve lectures are referenced individually.
Primary Keywords: Power Conditioning; Power Supplies; Pulse Voltage Circuits; Transmission Lines; Capacitors; Loads; Thyatrons; Ignitrons; Charging; Pulse Transformers; E-beam; Grounding And Shielding

698 NONADIABATIC ENERGY TRANSFER BETWEEN COUPLED L-C RESONATORS AND ITS POSSIBLE APPLICATIONS TO HIGH-POWER RF PULSE GENERATION

I. Seto, K. Minami and K. Ishii,
Nagoya University, Nagoya, Japan
No. IPPIJ-32, 53p (09/1979).

Availability:

NTIS

A principle of high-power RF pulse generation available in nuclear fusion research is proposed. The RF energy stored in L-C resonators with variable resonant frequencies is transferred to a load resonator when the frequency crossing occurs. Successive energy transfers from resonators result in a sustained RF oscillation at the load. It is emphasized that the successive triggering is not required in the present method. This simplifies substantially the operation of the RF generators. The principle is analyzed and numerically calculated for practical experimental conditions. An example of the conceptual designs of the variable inductor used in the present method is shown. At the frequency 1 MHz (4 MHz), the output 110 kW (460 kW) and the pulse width 24 sec (6 micron sec) are expected, if one uses two toroidal ferrite cores with a major radius 0.5m and a minor radius 0.2m.

Primary Keywords: Energy Transfer; Inductors; Nonadiabatic Conditions; Pulse Generators; Radio Frequencies; Resonators; Heating; Induction Heating; Nuclear Fusion; Radio Frequency Heating

Secondary Keywords: NTISNASA; NTISFNA

701 (SWITCHES, OPENING)

(Explosive Fuses)

ELECTRICAL EXPLOSION OF CYLINDRICAL FOILS IN AIR II. HIGH-CURRENT SHUNT PINCH

V.A. Burtsev, V.A. Dubovskii, N.P. Egorov, M.P. Kasatkina, A.B. Produnov and I.V. Shestakov

D.V. Efremov Institute, Leningrad, USSR

Soviet Physics Technical Physics, Vol. 23, No. 9, pp 1051-1055

(09/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 48, pp 1845-1852
The properties of the high-current pinch produced in the electrical explosion of a cylindrical aluminum foil in air are studied experimentally. With a thick foil the light pulse emitted from the plasma becomes a strong shockwave emission is obtained at wavelengths 270 nm < lambda < 500 nm. A current reversal arises in part of the plasma which coincides with the space-time position of the secondary shock wave. 9 Refs.

Primary Keywords: Exploding Cylindrical Foils; High-current Shunt Pinch; Cylindrical Aluminum Foil; Plasma Shock Wave

COPYRIGHT: 1979 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

704 (SWITCHES, OPENING)

(Explosive Fuses)

ELECTRICAL EXPLOSION OF CYLINDRICAL FOILS IN AIR I. ELECTRICAL CHARACTERISTICS OF THE EXPLOSION

V.A. Burtsev, V.A. Dubovskii, N.P. Egorov, M.P. Kasatkina, A.B. Produnov and I.V. Shestakov

D.V. Efremov Scientific Research Institute, Leningrad, USSR
Soviet Physics Technical Physics, Vol. 23, No. 7, pp 882-896 (07/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 48, pp 1419-1427

The experimental apparatus is described together with the diagnostic methods used to study the electrical explosion of cylindrical foils in air and the properties of the high-current shunt discharge. Experiments on the characteristics of the electrical explosions of cylindrical aluminum foils in air are reported. 23 Refs.

Primary Keywords: Cylindrical Foils; High-current Shunt Discharge; Megamphere Current Switch; Suppressed Edge Effects

COPYRIGHT: 1979 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

707 (POWER CONDITIONING)

(Pulse Transformers)

USE OF TRANSFORMERS IN PRODUCING HIGH POWER OUTPUT FROM HOMOPOLAR GENERATORS

M.H. Lupton, R.D. Ford, D. Conte, H.B. Lindstrom and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20373

2nd IEEE International Pulsed Power Conference Proceedings, pp 83-86
(06/1979).

Analysis is presented for systems using high current pulse transformers to exploit the high energy storage capability of homopolar generators or other limited current sources. The stepped-up secondary current can be established either by current interruption where the energy is also lost for energy storage or by commutation of current into the primary from a separate storage inductor. For high-power pulse generators the primary insulation and power supply are protected by subsequent crowbarring of the primary. An example is given of a design for matching the NRL homopolar generator with 1.46 mH inductor to a 1-microH, megavolt level inductive pulse generator. 6 Refs.

Primary Keywords: Pulse Transformer; High Current; Crowbar; Inductive Energy Storage

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

708 (SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)

VERY FAST, HIGH PEAK POWER PLANAR TRIODE AMPLIFIERS FOR DRIVING OPTICAL GATES

M.M. Howland, S.J. Davis and W.L. Gammie

Lawrence Livermore Lab, Livermore, CA 94550

2nd IEEE International Pulsed Power Conference Proceedings, pp 246-249
(06/1979).

Recent extensions of the peak power capabilities of planar triodes have made possible the latter's use as very fast pulse amplifiers, to drive optical gates within high-power Nd-glass laser chains. These pulse amplifiers switch voltages in the 20 kV range with rise times of a few nanoseconds, into crystal optical gates that are essentially capacitive loads. This paper describes a simplified procedure for designing these pulse amplifiers. It further outlines the use of bridged-T constant resistance networks to transform load capacitance into pure resistance independent of frequency. 4 Refs.

Primary Keywords: Pulse Amplifier; Planar Triode; Miller Effect; Grounded Grid

Secondary Keywords: Pockels Cell

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

714 (PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)

EXPLOSIVE MAGNETIC FLUX COMPRESSOR PLATE GENERATORS AS FAST HIGH-ENERGY POWER SOURCES

P.S. Cairns, D.J. Erickson, W.B. Gann and C.M. Fowler

Los Alamos National Labs, Los Alamos, NM 87545

1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-3 (11/1976). A type of explosive driven generator called a plate generator, is described. It is capable of delivering electrical energies in the MJ range at 1MW power levels. Plane wave detonated explosive systems accelerate two large-area metal plates to high opposing velocities. An initial magnetic field is compressed and the flux transferred to an external load. The characteristics of the plate generator are described and compared with those of other types of generators. Methods of load matching are discussed. The results of several high-power experiments are also given. 5 Refs.

Primary Keywords: Flux Compression Generator; Plate Generator;

Performance Comparison; Load Matching

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

716 (SWITCHES, CLOSING)

(Thyristors)

HIGH VOLTAGE, LOW INDUCTANCE HYDROGEN THYRATRON STUDY PROGRAM

R.F. Ceristri and D.V. Turnquist

EGIG Inc, Salem, MA 01970

ERACOM Report No. DELET-TR-2977-F (01/1981).

Availability:

NTIS

The second phase of a multi-phase program of research and development to gain the information necessary to fabricate a high voltage, low inductance hydrogen thyatron switch has now been completed. The thyatron is to be capable of switching tens of kiloamperes within tens of nanoseconds at voltage levels as high as 25 kV. In addition, ion induced current in the thyatron is operated within a close-fitting coaxial current return. Both the tube and the return are made physically short, and the tube is designed such that the discharge is constrained to flow principally at the outer reaches of the device. A technique has been developed for modelling various types of box grids and then using computer-generated field plots to aid in the specifics of grid design. This model has been used to generate a comprehensive set of theoretical relations that are useful to determine the anode dissipation to be expected. Experimental results are described and discussed. Included are the ceramic test results, hot doff vs. time on charge and gas pressure, stage voltage addition, operation at high pulse repetition rates, current rise time as a function of gas pressure, and the triggering characteristics of multi-stage box-grid tubes. Finally, the design of an intermediate experimental tube is discussed at length. This tube is expected to have an inductance less than 50nH and to operate at 15kV. 5 Refs.

Primary Keywords: Thyatrons; Switches; Pulse Generators; Blumlein; Pulse Modulators; Nanosecond Pulses; High Voltage Components

725 (POWER CONDITIONING)

(Clippers)

SOLID STATE CLIPPER DIODES FOR HIGH POWER MODULATORS

S. Levy and J.E. Creedon

ECOM, Fort Monmouth, NJ 07703

1978 IEEE Pulsed Power Modulator Symposium, pp 60-65 (06/1978).

End-of-line solid-state clipper diodes are essential to high power pulse modulators. These diodes are chosen to reduce the potentially damaging inverse network and switch voltages which occur when the load is less than the network impedance; especially when non-constant loads are encountered. The choice of the clipper diode stacks for a Megawatt (MW) average power pulser resulted from a study of commercially available units. Destructive tests of available units gave a figure of merit of 300:1 for the maximum single shot 10 Microsecond current pulse to diode rated average current. A 150 Ampere (A) average current diode was chosen for the 20,000 A worst case expected in the MW pulser giving a current safety factor of better than 2:1. For the 40 kilovolt (kV) pulser operation at a 1.5:1 voltage safety factor required 60 of the 1.0 kV diodes in series. A snubber circuit and resistor stack which provided equal voltage division and transient turn-on protection. Transient response of the snubber protected diode stacks was modeled at low powers and later confirmed in actual MW pulser operation. 18 Refs.

Primary Keywords: End Of Line Clipper; Low Impedance Load; Non-constant Load; Reflected Voltage; Diode Tests; Snubber

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

728
(INSULATION, MATERIAL)
(Liquid)

THE COOLING OF OIL-FILLED ELECTRICAL EQUIPMENT, WITH SPECIAL REFERENCE TO HIGH POWER LINE-TYPE PULSE GENERATORS

G. Scopes
English Electric Valve Co Ltd, Chelmsford, Essex, UK

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-4 (11/1976). Various methods are described for cooling the oil used to insulate the component parts of high voltage, high power line-type pulse generators and their power supplies. Effects of various magnetic components, charging inductors, pulse-forming networks, pulse transformers, etc., as well as the actual switching device are such that as much as 15 to 20% of the power consumed is likely to be dissipated as heat. A number of cooling systems are described, ranging from simple air convection to those using chimneys or fan-forced air. Water cooled heat exchangers also include those using convection in the oil as well as systems using pumps or propellers to cause the oil to flow rapidly past the cooled surfaces. The rate of heat extraction with these various systems can vary over a ratio of 1:100, in terms of Watts per square foot of cooling surface per degree centigrade above ambient. Empirical results and formulae are given which enable the user to calculate heat extraction to a few percent in the majority of cases. 2 Refs.

Primary Keywords: Oil Filled Equipment; Cooling; Efficiency; Convection; Forced Circulation; Water Cooling

Secondary Keywords: Line-type Pulse Generators

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

733
(PULSE GENERATORS)
(Flux Compression)

EXPLOSIVE ELECTRICAL GENERATOR

E.I. Azerkavich, A.E. Voitenko, V.P. Isakov and Yu.A. Kotov
S.M. Kirov Tomsk Polytechnical Institute, Tomsk, USSR

Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1141-1144 (09/1976).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 46, pp 1957-1962

An experimental prototype of an explosive electrical generator is described. This device uses the energy of an explosion to produce electrical pulses in a resistive load. It consists of an explosive magnetoclectric source, a fast-acting breaker, an explosion chamber, and other elements. A current of 140 kA was produced in a resistive load at a voltage of 130 kV with a pulse length of 3.5 μ sec. 21 Refs.

Primary Keywords: Explosive Generator; Resistive Load; 140 KA Current

Pulse

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

737
(PARTICLE BEAMS, ELECTRON; SWITCHES, OPENING)

(Generation: Explosive Fuses)

HIGH-CURRENT NANOSECOND-PULSE ELECTRON ACCELERATOR WITH INDUCTIVE SHAPING ELEMENT

Yu.A. Kotov, B.M. Koval'chuk, N.G. Kolganov, G.A. Mesyats, V.S. Sedov and A.L. Ipatov
Soviet Physics-Technical Physics Letters, Vol. 3, No. 9, pp 359-360 (09/1977).

Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 883-886 (September 1977).

The traditional high-current nanosecond accelerator contains a 'slow' energy storage bank, usually a pulse voltage generator, a 'fast' bank, or a shaping line with a switching system, and a vacuum diode. Accelerators of this type are reviewed elsewhere. For electron energies above 166 eV, for currents >50 kA, and for pulse lengths of 50 nsec or more, these accelerators become large, complicated, and expensive. Furthermore, the pulse length in these accelerators is essentially fixed since it is governed by the length of the shaping line. Low-energy pulsed accelerators in which the role of the 'fast' storage bank is played by the inductance of an LC circuit with an exploding-wire current source are discussed elsewhere. In the present letter we describe an accelerator which uses the same principle, but with pulse energy of the order of 1E4 J. This accelerator is designed for operation with short pulses (accelerator voltage U up to 2 MV, current I up to 50 kA, and pulse length t up to 100 nsec) and long pulses (U up to 500 KV, I up to 25 kA, and t up to 2.5 microsecond). 4 Refs.

Primary Keywords: Stacked Lines; Exploding Wire; Inductive Energy Storage; Pulse Transformer; Field-emission Diodes

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

739
(BREAKDOWN STUDIES)

(Gas, Electrical)

CHARACTERISTICS OF IMPULSE BREAKDOWN OF STANDARD ROD GAPS UNDER CONTROLLED-ATMOSPHERE CONDITIONS

J.E. Matthews and R. Saint-Arnoult
University of Strathclyde, Glasgow, Scotland

Proceedings of The IEE, Vol. 117, No. 10, pp 1524-1527 (10/1971). The effect of humidity on the impulse breakdown of rod-rod gaps is considered in this paper, along with the influence of gamma irradiation and polarity effects. It was found that the breakdown voltage increased in all cases except one, where the corona was believed to play a dominating role. A polarity effect was observed in nonirradiated gaps but is probably due to stray capacitance with the grounded vessel. Gamma irradiation of the gas produced strong polarity effects and breakdown voltage was reduced. 20 Refs.

Primary Keywords: Impulse Breakdown; Humidity Effect; Radiation Effect; Gamma Radiation; Polarity Effect; Breakdown Voltage vs Humidity

COPYRIGHT: 1971 IEE

743
(DIAGNOSTICS AND INSTRUMENTATION)
(Reviews)

NANOSECOND PULSE MEASUREMENTS

C.M. Winnigstad
Tektronix Inc., Beaverton, OR
IRE Western Electronic Show And Convention (WESCON) Paper 23/1 (08/1961).

Nanosecond pulse propagation is analyzed utilizing transmission line analysis techniques. In this paper, TEM transmission lines (coaxial cable, strip lines, etc.) are shown to play a significant role in nanosecond pulse propagation for most applications. These analysis techniques are used to determine pulse delay characteristics, stray capacitance, inductance of signal injection and removal points. Design criteria are presented for voltage and current probes and sources, switches, and trigger circuits. 18 Refs.

Primary Keywords: Transmission Line Theory; Current Probe; Voltage Probe; Skin Effect; Signal Source

COPYRIGHT: 1964 TEKTRONIX INC.

745
(ENERGY STORAGE, INDUCTIVE)

(Systems)

A PROPOSAL FOR THE CONSTRUCTION AND OPERATION OF AN INDUCTIVE STORE FOR

20 MJ

E.X. Inall
Australian National University, Canberra, Australia
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 679-685 (07/1972).

A proposal for coupling 15 MJ of energy initially stored in the Canberra homopolar generator, to a load in about 1.0 ms is described. 22 MJ is first transferred to a coaxial inductor at a peak current and voltage of 1.5 MA and 190 V respectively. Fast mechanical switches which are being developed would open to produce a potential of 1000 V and a peak power of 15 GW into the load. Information is given on the operation of a small version of the system being used to supply 100000 J to a high power laser amplifier. 6 Refs.

Primary Keywords: Coaxial Inductor; Homopolar Generator; Mechanical Switch; Transfer Time; 1000 V Output Voltage

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

746

(SWITCHES, CLOSING)

(Gas Gaps; Optical)

LASER TRIGGERING THROUGH FIBER OPTICS OF A LOW-JITTER SPARK GAP

H.C. Barnes, K.H. Schonbeck, M. Kristiansen, A.H. Guenther and L.L. Hatfield

Texas Tech University, Lubbock, TX 79409

IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 170-176 (09/1980).

An optical filter is employed to transport a 15-ns light pulse from a high power ruby laser for precise triggering of a gas filled high voltage spark gap. The maximum power density that can be transmitted by the fiber is limited to 6E12 W/cm², above which laser induced damage occurs on the fiber entrance face. The overall throughput efficiency of the optical system was measured as 62 percent. Results are presented for the switching delay time and associated jitter for various mixtures of Ar and N₂/He gas, and as a function of the voltage across pulse-charged Blumlein generator gap. Pulse charging of the Blumlein generator was accomplished by a three-stage Marx generator, resulting in output voltages up to 250 kV. It was conclusively demonstrated that an optical fiber will transport a sufficiently intense laser pulse to induce subnanosecond jitter in the triggering of a pressurized gas switch under the conditions studied. 5 Refs.

Primary Keywords: Laser Triggered Spark Gap; Fiber Optic; Ruby Laser; Power Density Limitation; Subnanosecond Jitter

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

747

(SWITCHES, CLOSING)

(Gas Gaps; Electrical)

LONG-LIFE HIGH-REPETITION-RATE TRIGGERED SPARK GAP

H. Watson
Airframe Co., Torrance, CA 90509

IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 154-159 (06/1980).

A forced-air-blown triggered spark gap (TSG) switch system capable of high repetition rates on a continuous basis as well as a TSG comparative study is described. The system consists of two TSG's, each discharging its own 30-ohm pulse cable into a common load. The system was operated at 30 kV, 1 kHz, for 39E6 shots with erosion rates of approximately 60 mg/amp-hour. Each TSG discharged 0.423 joules in 60 nsec (FWHM) per pulse. The switching losses were about 28 percent of the stored cable energy. Calculations indicate this can reduce to 14 percent by optimizing the TSG design and surrounding air channel insulation for a more uniform E-field. Test results indicate a multi-level assembly capable of switching 50 kA or more 40- to 100-nsec pulses at 1 kHz from 50 kV for 500E6 shots without gap adjustment is feasible with this concept. The work was partially supported by the U.S. Energy Research and Development Administration under Contract No. ER-74-C-0048. 4 Refs.

Primary Keywords: Rep-rated; Life Test; Electrode Erosion; Efficiency; Field Uniformity

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

749
(SWITCHES, CLOSING; SWITCHES, CLOSING)

(Gas Gaps; Self; Gas Gaps, Recovery)

TESTING OF A 100-KV 100-HZ REP-RATE GAS SWITCH

A. Ramrus and J. Shannon

Maxwell Labs Inc, San Diego, CA 92123

IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 160-162 (09/1980).

A two-electrode gas switch with a self-breakdown voltage of 100 kV was operated at a pulse-repetition rate (PRR) of 100 Hz with bursts up to 10 s in duration. The output of a pulse transformer provided the (1- \cos) square waveform which charged the switch in about one-half ms. The switch discharged with an open circuit of about 10 kA and a total charge of approximately 10 mC into a damped LC circuit. A continuous flow of air through the interelectrode spacing enabled the switch to recover its breakdown voltage between discharges. Flow rates up to 35 standard cubic feet per minute (scfm) were employed. This paper discusses the dependence of switch jitter and waveform reproducibility on airflow rate. 3 Refs.

Primary Keywords: Two Electrode Gas Gap; Air Gap; High Flow Rate; Rep-rated; Performance Test

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

751

(PARTICLE BEAMS, ELECTRON)

(Generation)

ANODE BEHAVIOR IN HIGH INTENSITY FIELD EMISSION DIODES

E. D'Inno, G. Leggeri, A. Lucherini, V. Nassisi, A. Perrone and M.R. Perrelli

Universita di Lecce, Lecce, Italy

Journal Of Vacuum Science And Technology, Vol. 17, No. 4, pp 838-841 (08/1980).

The effects of energy loss in the anode foil of a field emission vacuum diode are considered experimentally and theoretically. The authors calculate the temperature rise in stainless steel foil for several beam energies and currents and 15 ns duration. The temperature rises calculated were not found to be sufficient to induce foil breakdown though experimental observation confirmed that this was, indeed, the case. A theory is presented to explain this discrepancy. 14 Refs.

Primary Keywords: Field Emission Diode; Anode Foil; Beam Energy

Deposition; Foil Heating

COPYRIGHT: 1980 THE AMERICAN VACUUM SOCIETY

- 763**
(SWITCHES; CLOSING)
(Gas Gaps; Materials)
EROSION OF SPARK GAP ELECTRODES
R. A. Petr and T. R. Burkes
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 149-153
(09/1980).
 The erosion characteristics of spark gap electrodes operating with 10- and 20-microsecond square current pulses for various materials is presented. Cathode spot size and lifetime for electrode spot formation are estimated. Also, the effect of the acoustic properties on electrode erosion is described. 18 Refs.
Primary Keywords: Electrode Erosion; Square Current Pulse; 10-20 Microsecond Current Pulse; Several Electrode Materials; Cathode Spot; Anode Spot
COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION
- 770**
(PARTICLE BEAMS, NEUTRAL)
(Generation)
LARGE AREA NEGATIVE ION SOURCE FOR HIGH VOLTAGE NEUTRAL BEAMS
P. Poulsen and E.B.J. Hooper
Lawrence Berkley Lab, Berkley CA
No. CCRF-791C2-89, 7p (11/1979).
Avalability: LBL-12081
NTIS:
 A source of negative deuterium ions in the multi-ampere range is described that is readily extrapolated to reactor size, 10 amp or more of neutral beam, that is of interest in future experiments and reactors. The negative ion source is based upon the double charge exchange process. A beam of positive ions is created and accelerated to an energy at which the attachment process $D + M \rightarrow D_{exp}^- + M_{exp}^+$ proceeds efficiently. The positive ions are atomically neutralized either in $D_{sub} 2$ or in the charge exchange medium M . Atomic species make a second charge exchange collision in the charge target to form D_{exp}^- . For a sufficiently thick target, the beam reaches an equilibrium fraction of negative ions. For reasons of efficiency, the target is typically alkali metal vapor; this experiment uses sodium. The beam of negative ions can be accelerated to high (>200 keV) energy, the electrons stripped from the ions, and a high energy neutral beam formed. (ERA citation 05:014551)
Primary Keywords: Ion Sources; Neutral Beam Sources; Beam Neutralization; Collisions; Charge Exchange; Design; Deuteron Ions; Key Range 100-1000; Size
Secondary Keywords: ERDA/700205; NTISDE
- 776**
(BREAKDOWN STUDIES)
(Gas, Electrical)
PLASMA CONTRACTION CAUSED BY THE MAGNETIC FIELD OF THE CURRENT IN AN ELECTRON-BEAM-SUSTAINED DISCHARGE
V.V. Vladimirov, V.N. Gorshkov, V.F. Shandikov and A.I. Shchedrin
Academy of Sciences of the Ukrainian SSR, Kiev
Soviet Physics-Techical Physics, Vol. 49, No. 11, pp 1393-1394
(11/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2473-2474 (November 1979)
 The externally sustained discharge has found widespread use in high-power gas lasers. Theory on the electron-beam-sustained discharge predicts a marked change in the spatial distribution of the beam electron energy loss as a result of the magnetic field produced by the discharge current. In turn, this nonuniform spatial distribution of the energy loss leads to nonuniform pumping of energy into the active medium, so that the optical emission suffers in quality. As we will show in the present paper, for discharge parameters in the 200-400 keV, 2 A/cm² ranges, magnetic mirrors can arise which prevent beam electrons from penetrating into the discharge gap, with the consequence that the useful volume of the working chamber is reduced. 4 Refs.
Primary Keywords: Electron-controlled Discharge; Spatial Discharge Distribution; Discharge Current; Discharge Field; Magnetic Mirror.
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 778**
(BREAKDOWN STUDIES)
(Gas, Electrical)
PULSED BREAKDOWN OF GASEOUS HELIUM AT LOW TEMPERATURES
V.A. Avgustinovich (1) and Yu.G. Yushkov (2)
(1) Scientific-Research Institute Of Nuclear Physics
(2) Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 49, No. 11, pp 1415-1416
(11/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2502-2503 (November 1979)
 An effort is currently being made to develop high-voltage devices which operate at low temperatures. In certain situations, in order to transfer the energy stored in a superconducting solenoid or high-Q microwave resonators, switches which are capable of operating in an atmosphere of gaseous helium at low temperatures are required. 7 Refs.
Primary Keywords: Helium; Impulse Breakdown; Point-plane Gap; Low Pressure; 4.2 Deg.K.; 293 Deg.K.; Variable Voltage Rise Time
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 780**
(SWITCHES; CLOSING; SWITCHES, OPENING)
(Gas Gaps; E-beam; Gas Gaps; E-beam)
ROTATING ELECTRON-BEAM CONTROLLED SWITCHING
R.F. Fernandes (1), D. Conte (2) and I.M. Vitkovitsky (3)
(1) JAYCOR Inc, Alexandria, VA 22304
(2) Research and Development Associates, Arlington, VA 22209
(3) Naval Research Lab, Washington, DC 20375
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 176-180
(09/1980).
 Previous investigators have demonstrated the feasibility of using an ionizing electron beam to control the conductivity of a gaseous volume-discharge switch. We consider the possibility of using such switches repetitively at high-power levels (up to 1E10 W), with switch opening and closing times as short as several nanoseconds. An analysis of the relevant gas chemistry indicates that these requirements can best be met by using a noble-negative base gas with a high electron mobility, diluted with a small percentage of an electronegative gas, N_2 sub 2%, and the electronegative gas O_2 sub 2%.
Primary Keywords: Nanosecond Closing Time; Nanosecond Opening Time; Chemical Simulation; Nitrogen Gaps; Oxygen Gaps; Mixture; Reprinted; Theory
COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION
- 782**
(PULSE GENERATORS)
(Trigger)
SIMPLE PULSE GENERATOR FOR A POWERFUL MODULATOR
B. Sagnolo
Università di Palermo, Viale delle Scienze, Italy
The Review Of Scientific Instruments, Vol. 51, No. 8, pp 1134-1136
(08/1980).
 A pulse generator circuit with pulse length 2.5 microns, peak voltage 1 kV, pulse repetition frequency 25-500 Hz, is described. This pulser may be used as a trigger for the thyatron of a 'line-type modulator'. 3 Refs.
Primary Keywords: 1 kV Output; Thyristor Pulser; 200 ns Rise Time; Low Impedance; Rep-rate
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 793**
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
MAGNETIC FIELD SENSITIVITY OF AN OPTICAL FIBER WITH MAGNETOSTRICTIVE JACKET
J. Jarzynski (1), J.H. Cole (1), J.A. Bucaro (1) and C.M. Davis (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Dynamic Systems, Inc., McLean, VA 22102
Applied Optics, Vol. 19, No. 22 pp. 3746-3748 (11/1980).
 The authors derive expressions for the magnetically induced strain in an optical fiber with a finite magnetostrictive jacket. The effect of jacket thickness on the magnetic field sensitivity and pressure sensitivity of an optical fiber is calculated. 8 Refs.
Primary Keywords: Magnet Field Measurement; Optical Fiber; Magnetostrictive Jacket; Phase Shift
Secondary Keywords: Strain Calculation
COPYRIGHT: 1980 OPTICAL SOCIETY OF AMERICA
- 801**
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A NANOSECOND RISE TIME DIFFERENTIAL PULSE TRANSFORMER
G.E. Albergo
Eindhoven University of Technology, Eindhoven, Netherlands
Journal Of Physics E: Scientific Instruments, Vol. 13, pp 1009-1010
(01/1977).
 A differential pulse transformer with a rise time of less than 2 ns and a drop of less than 1% for pulse widths up to 200 ns is described. The device was primarily designed for the determination of small voltage differences in pulsed experiments on hole electrons in semiconductors. Special attention is paid to the systematic and random errors which may arise at the determination of differences. 4 Refs.
Primary Keywords: Instrumentation Transformer; Transmission Line
COPYRIGHT: 1980 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 828**
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
A MODEL AIR-SUPPORTED DRUM-TYPE HOMOPOLAR GENERATOR
R.L. Kustom, R.E. Fuja, R.B. Wehrle, R.P. Smith and T.J. Kovarik
Argonne National Lab, Argonne, IL
Argonne Report No. CONF-771132-6 (11/1977).
Availability: CONF-771132-6
NTIS:
 A single cylinder, drum-type homopolar generator has been designed and built for the purpose of developing a simple air support system for thin cylinder rotors, operated at high surface velocities and significant radial drum growth. The model has an aluminum cylinder which is 0.32 cm thick, 25 cm in diameter, and 12.7 cm long. It is designed to operate at a peak current of 2500 A and to store a total of 40 kJ with a surface velocity of 305 m/sec. The drum is mounted over a fiberglass cylinder with its axis vertical. The space between the drum and the fiberglass cylinder form a pressurized air cavity. The drum is bounded between flat surfaces. Air escapes from the cavity between the edges of the cylinder and the flat surfaces. This provides the air lift to support the cylinder. Brushes are located at the edges of the cylinder in four clusters of eight brushes. The brush diameter is 0.36 cm. The peak current density is 781 A/cm². The brush material is Manganite CMIS. A radial magnetic field is provided by an iron core system using two copper coils. The field strength is 1.05 T. The model is in the initial stages of operation. It has been operated at 350 rpm with a DC current of 100 A to test the air support system. It has been pulsed with 500 A peak current. Some problems have been encountered in the brush holder system which have required modifications. These modifications are in progress. 4 Refs.
Primary Keywords: Air Bearing; High Surface Velocity; Large Radial Drum Growth; Vertical Axis
- 831**
(SWITCHES; CLOSING; SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps; Materials; Vacuum Gaps; Materials; Electrodes)
ELECTRODES FOR HIGH-CURRENT COMMUTATORS
Yu.S. Pavlov and S.A. Smirnov
Physicochemical Institute, Academy of Sciences of the Ukrainian SSR,
Instruments And Experimental Techniques, Vol. 14, No. 1, pp 132-134
(02/1971).
Trans. From: Fizika i Tekhnika Experimenta 1, 118-120
 (January-February 1971).
 This article describes two constructions of electrodes which provide for the directional movement of the discharge and its confinement within a specified region. The tests were carried out with current pulses of up to 100 kA in the range of pulse lengths up to 3 msec at atmospheric pressure and in a vacuum. It was established that the electrodes have a comparatively small erosion, while the ignition devices mounted on them are not covered with molten metal. As a result, the operating resource of arc gaps having such electrodes is increased considerably. 4 Refs.
Primary Keywords: Electrode; Gas Gap; Vacuum Gap; Expanding Arc; Rotating Arc; Erosion Measurement; 100 kA Current
COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION

832
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Electrodes; Liquid Gaps; Materials)

DEPENDENCE OF ELECTRODE EROSION UPON FORM OF CURRENT PULSE

A.I. Kruglov and V.N. Fokin
EFD Report No. EFD-TT-64-857/1+2 (01/1965).

Trans. From: Elektrotskaya Obrabotka Metallov Izdatel'stvo Akademii Nauk SSSR, 29-37 (1963)

Availability: AD 610075
NTIS

The authors show that the erosion of a copper or brass electrode immersed in kerosene is dependent not only on total charge passed by the electrode, but also on the shape of the current. Two pulse forming lines with pulse widths 1.5 and 20-microseconds, were utilized together to produce a pulse with variable shape. Peak currents were 60 A for the long pulse and 400 A for the short pulse. Evidence is presented that electrode erosion is significantly dependent on pulse shape parameters in a manner not predicted by previous theories. 7 Refs.

Primary Keywords: Electrode Erosion; Pulse Shape; Low Current; Long Pulse; Rectangular Pulse; Significant Dependence

833
(PARTICLE BEAMS, ELECTRON)
(Generation)

DEVELOPMENT AND INVESTIGATION OF RELATIVISTIC ELECTRON BEAMS WITH FINITE ENERGY SPREAD AND IMPROVED EMITTANCE

J. Fink, H.D. Schilling and U. Schumacher
Max-Planck-Institut Fur Plasmaphysik, Garching, FRG

Journal Of Applied Physics, Vol. 51, No. 6, pp 2995-3000 (06/1980).

This paper presents experimental results in the development of low-emittance relativistic electron beams with finite energy spread, which - among other applications - is suitable for suppressing collective instabilities in an electron-positron accelerator. The electron-beam gun, one half of which is connected via a resistor with the high-voltage terminal. The energy difference can be varied up to 100 keV in proportion to the resistance, with equal subcurrents. The beam parts are well separated, and their radial distance is about equal to the radial difference of the corresponding electron closed orbits, such that electron-ring formation with minimum radial betatron oscillations should be possible. The beam emittance is as small as about 100 mrad cm and the current is 800 A. 17 Refs.

Primary Keywords: Electron Ring Accelerator; 100 Mrad Cm Emittance; 800 A Current

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

834
(SWITCHES; CLOSING)
(Gas Gaps; E-beam)

AN ELECTRON-BEAM-TRIGGERED SPARK GAP

K. McDonald (1), M. Newton (1), E.E. Kunhardt (1), M. Kristiansen (1) and A.H. Guenther (2)

(1) Texas Tech University, Lubbock, TX 79409

(2) AFML, Kirtland AFB, NM 87117

2nd IEEE International Pulsed Power Conference Proceedings, pp 437-441 (06/1979).

Studies on the triggering of a high-voltage, gas-insulated spark gap by an electron beam have been conducted. Ristetimes of approximately 2-3 ns and subnanosecond jitter have been obtained for 1-cm gaps with gap voltages as low as 50% of the self-breakdown voltage (variable to 1 MV). The switch delay (including the diode) was 50 ns. The working media were N₂/sub 2/, and mixtures of N₂/sub 2/ and Ar, and of N₂/sub 2/ and SF₆/sub 6/ at pressures of 1-3 atm. Open shutter photographs show that the discharge is broad in cross-section. Voltage, current, and jitter measurements have been made for a wide range of gap conditions and electron-beam parameters. Variations in the character of the discharge have been inferred using streak and open shutter photography. Correlation between electron beam width, beam energy, discharge channel width, current rise time, delay, and jitter are discussed. 7 Refs.

Primary Keywords: E-beam Triggering; High Voltage; Fast Rise; Low Jitter; Wide Trigger Range

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

835
(SWITCHES, CLOSING)
(Gas Gaps; Electrical)

A 3-MV LOW-JITTER TRIGGERED GAS SWITCH

D.B. Cummings and H.G. Harmon III
Physics International Co., San Leandro, CA 94577

2nd IEEE International Pulsed Power Conference Proceedings, pp 446-449 (06/1979).

Physics International Company has designed, built, and tested a 3 MV, low jitter, triggered gas switch. The switch operates in a 16.5 ohm coaxial pulse line. The system design requires that the pulse line switches perform the difficult task of first holding off the reverse pulse charge, then holding off the forward pulse charge, then finally triggering on command. The trigger for the switch is generated by a trigger Marx placed within the output pulse line. The remainder of the triggering circuit includes a trigger isolation gap. A V/N-type trigger electrode is situated within the main gap. To date, the switch has been shown to hold voltage and trigger reliably for pulse charges from 0.9 MV to 2.5 MV. The rms jitter of the switch firing time is less than 6 ns. At an operating voltage of 2.5 MV, the switch transfers a charge of up to 0.1 coulomb per shot, with a peak current of 20 kA. 2 Refs.

Primary Keywords: Electrically Triggering; Very High Voltage; Reverse Voltage Holdoff; Low Jitter

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

871
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, MECHANICAL)
(Inductors; Rotating Machines)

COMPUTER BASED ELECTRICAL ANALYSIS OF HOMOPOLAR GENERATOR DRIVEN

BUTTER PLATE STORAGE INDUCTORS WITH RADIAL CURRENT DIFFUSION

D.J. Mayhall, H.G. Rylander, W.F. Weldon and H.M. Woodson

University of Texas at Austin, Austin, TX 78712

2nd IEEE International Pulsed Power Conference Proceedings, pp 330-332 (06/1979).

Maxwell's equations are solved for the operational admittance in the magnetic quasi-static approximation for nonmagnetic cylindrical coils with azimuthal current and axial magnetic fields. An infinite series, Bessel function solution is obtained and solved for copper coils with given physical dimensions. Coil turns numbers and lengths with series resistances and inductances. A multiple branch shunt network coil model with series resistances and inductances is derived. The UT OEM 5 MJ homopolar generator is modeled with a torque-speed equation including brush and seal drag torques. The brush contact voltage drop is modeled versus surface speed and brush current. Transmission system resistances and inductances are included. Effective depths of current penetration, effective coil resistances and inductances, and peak temperatures are calculated versus time. Coil currents and voltages are obtained, as are system energy storage and dissipations. Peak current times and system discharge times are determined. Slightly underdamped configurations are found. 1 Refs.

Primary Keywords: Homopolar Generator; Analysis; Modelling; Design Parameters

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

873
(DIAGNOSTICS AND INSTRUMENTATION)

E FIELD

ELECTRIC POTENTIAL MEASUREMENTS IN GASEOUS INSULATING MATERIALS BY COPDRA PPCEB IN A CONTROLLED ENVIRONMENT

S. Bertolini, A. Coertito and G. Sciuotto

University of Genoa, Genoa, Italy

IEEE Transactions On Instrumentation And Measurement, Vol. IM-29, No. 2, pp 125-130 (06/1980).

The experimental determination of electric potential in gaseous insulating materials is performed using a corona probe. This method can be used to measure point values of electric potential from dc to ac at industrial frequency values. The proposed method, after an initial calibration of the electric potential at the point in space where the tip of the probe is located, the measurement is performed by adjusting the feeding potential of the probe until a complete corona suppression is obtained. To discriminate the corona effect of the probe from other possible corona sources, a device for probe current detection is proposed. The corona probe method has been verified by measuring electric potential, under both dc and 50-Hz ac conditions, in known field configurations and in natural and controlled environments. Finally, the proposed method has been applied to determining the space distribution of the electric potential around high-voltage insulating structures under dc and 50-Hz voltages in a natural environment. 12 Refs.

Primary Keywords: DC And 50-Hz; Spatial Distribution; Negative Potentials; Corona Current Measurement

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

875
(SWITCHES, OPENING)

(Vacuum Gaps; Electrical)

EXPERIMENTS ON VACUUM INTERRUPTERS IN HIGH VOLTAGE 72 KV CIRCUITS

R.E. Voroshilov, C.W. Franklin, P.G. Slade and J.G. Gorman

Westinghouse Research and Development Center, Pittsburgh PA

IEEE Transactions On Dielectric And Power Apparatus And Systems, Vol. PAS-99, No. 2, pp 658-666 (03/1980).

Three experimental 23 cm diameter vacuum interrupters have been built and their performance has been evaluated in single-phase high-voltage, high-current circuits. The first of these experimental designs contained 11.7 cm diameter, spiral electrodes and one floating arc shield. It interrupted bus circuits up to 42kV (72kV x 0.58)/15kA. The second and third prototype designs contained three floating arc shields. Prototype number 2, equipped with 16 cm diameter, spiral electrodes, passed single phase bus fault tests at 42 kV/40 kA and 63 kV/72 kV x 0.87/30 kA. The third prototype was designed to ensure that a diffuse vacuum arc could be maintained at very high currents. It interrupted fault currents in the range of 40kA to 60kA in a 33kV circuit. This design also showed potential for series operation at 145kV/55kA for both bus and short line fault situations. Test data are presented in this paper and are discussed with respect to electrode diameter, the contact gap at current zero and the need for maintaining a diffuse vacuum arc. 1 Refs.

Primary Keywords: Vacuum Interrupters; Magnetic Field Interruption Mechanism; Electrode Vapor; Interruption of Over 40kA (rms)

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

882
(SWITCHES; CLOSING; BREAKDOWN STUDIES)

Liquid Gaps; Self-Liquid; Electrical)

INDUCTIVE AND RESISTANCE CHARACTERISTICS OF SINGLE-SITE UNTRIGGERED WATER SWITCHES IN WATER TRANSFER CAPACITOR CIRCUITS

P.W. Spence, Y.G. Chen, G. Frazier and H. Calvin

Physics International Co., San Leandro, CA 94577

2nd IEEE International Pulsed Power Conference Proceedings, pp 359-362 (06/1979).

Inductive and resistance characteristics of single-site untriggered water switch arc-channels have been investigated by measurement of their effects on frequency and voltage gain in a water capacitor transfer circuit. Data are presented for two distinct switch configurations covering a voltage range from 3 to 6 MV, gaps from 7 to 35 cm, and mean switching fields from 150 to 350 kV/cm. A simple lumped circuit model is postulated with switch L and R varying linearly with gap spacing under low voltage conditions. Extrapolation of this model to higher voltage conditions compares favorably with measured circuit characteristics. Energy loss in the water switch is observed to be approximately a factor of two in excess of maximum losses predicted from previous estimates. 3 Refs.

Primary Keywords: Resistance; Inductance; Variation With Gap Spacing; High Voltage; Efficiency; Rise Time Measurement

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

885
(SWITCHES; CLOSING)
(Thyristors)

INSULATED-GATE PLANAR THYRISTORS. I. STRUCTURE AND BASIC OPERATION
J.D. Plummer and B.W. Scharff
Stanford University, Stanford, CA 94305
IEEE Transactions On Electron Devices, Vol. ED-27, No. 2, pp 380-387
(02/1980).

A high-voltage planar triac which is controlled by an insulated-gate terminal is described. Its structure is related to the DMOS transistor on which it is based and its multiple operating modes are discussed in terms of an equivalent circuit composed of MOS and bipolar transistors and resistors. A typical junction isolated device has a 100-V breakdown and an on-resistance less than 10 Ohms for a 400- μ m wide channel. The on-resistance can easily be scaled to very low values simply by increasing the device width. Extension of the MOS thyristor concept to other devices and higher voltages is described. Quantitative analysis and modeling of these new devices are described in a companion paper [23 Refs].

Primary Keywords: High Voltage Planar Thyristor; DMOS Transistor; Insulated Gate Control; Metal Gate Technology; Modeling

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

886
(SWITCHES; CLOSING)
(Gas Gaps; Optical)

LOW JITTER LASER TRIGGERED SPARK GAP USING FIBER OPTIC
L.L. Hause, D.W. Jitter, H.C. Harries, M. Kristiansen, A.H. Guenther and K.H. Schonbach
Texas Tech University, Lubbock, TX 79439
2nd IEEE International Pulsed Power Conference Proceedings, pp 442-445
(06/1979).

Laser triggering of a pulse charged gas switch is described. The laser triggering results in low jitter switching relative to the timing of the laser pulse. A novel feature is the use of a single, element, 1 mm. quartz, optical fiber to transmit the laser beam. The switch parameters, such as gas pressure, gas composition, and laser beam focal point location have been optimized to produce nanosecond delay and jitter with as little laser power as possible. The laser optical system has been optimized for best overall efficiency in a configuration suitable for illumination of many fibers by a single laser. Typical operating parameters for the switch are: 2 cm gap, 2500 Torr pressure, 50% Ar + 50% N₂ gas mixture, and a charging voltage of 200 kV. Laser power in the gas is typically a few megawatts with an overall efficiency greater than 30% for the optical system. 1 Refs.

Primary Keywords: Laser Triggering; Fiber Optic; Low Laser Power; Low Jitter; Multiple Gaps

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

889
(SWITCHES; CLOSING)
(Miscellaneous Solid State)

NEW TECHNOLOGIES ADVANCE POWER SEMICONDUCTOR STATE-OF-THE-ART
R. Denning and J. White
RCA Advanced Power Labs, Somerville, NJ
Solid State Technology (March 1980), pp 98-105 (03/1980).

Integrated manufacturability, performance, reliability and adaptability are features of a new series of discrete high voltage power devices. 16 Refs.

Primary Keywords: 1.5 KV Breakdown; 10A Current; Neutron Doping; Ion Implementation; Diffusion Process; Surface Electric Field Control; Siopos/Glass Passivation System; Metal Systems; Device Packaging; High Voltage Transistors; High Current Transistors

COPYRIGHT: 1979 RCA CORPORATION, REPRINTED WITH PERMISSION

895
(BREAKDOWN STUDIES)
(Capacitors)

POLARITY EFFECT MEASUREMENTS USING THE KERR ELECTRO-OPTIC EFFECT WITH COAXIAL CYLINDRICAL ELECTRODES
M. Zahn and T.J. McGuire
University of Florida, Gainesville, FL

IEEE Transactions On Electrical Insulation, Vol. EI-15, No. 3, pp 287-293 (06/1980).

Steady state solutions of the electric field and space charge density distributions using a drift dominated unipolar conduction model between coaxial cylindrical electrodes are reviewed and compared to experimental results obtained using the Kerr electro-optic effect. With coaxial cylindrical electrodes, Kerr measurements showed both positive charge injection at the inner cylindrical electrode was so strong that the space charge shielding caused the electric field at the inner cylinder to be minimum with the field increasing to the outer cylindrical electrode in complete contrast to the usual space charge free 1/r field dependence. This polarity effect is observed also for a sinusoidal ac high voltage with an essentially space charge free field when the inner cylindrical electrode was instantaneously negative, and a space charge distorted uniform field when the inner cylinder was instantaneously positive. 5 Refs.

Primary Keywords: Space Charge; Charge Injection; Kerr Electro-optic Measurements; Coaxial Electrode Models; Breakdown In Dielectrics

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

897
(SWITCHES; CLOSING; SWITCHES; OPENING)
(Gas Gaps; E-beam; Gas Gaps; E-beam)

REPETITIVE ELECTRON BEAM CONTROLLED SWITCHING
R.F. Fernsler, D. Conte and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 368-371
(06/1979).

Previous investigators have demonstrated the feasibility of using an ionizing electron beam to control the conductivity of a gaseous volume-discharge switch. We have considered the possibility of using such a switch repetitively at high power levels (up to 1E10 W), with switch opening and closing times as short as several nanoseconds. An analysis of the relevant gas chemistry has indicated that these requirements can best be met by using a non-electronegative noble gas diluted with a small percentage of an electronegative gas. Detailed chemistry simulations, using the non-electronegative gas 0₂/N₂ 2/1, have been performed and will be presented to support this analysis. Also discussed will be the limitations imposed by switch heating and gas breakdown. 6 Refs.

Primary Keywords: Volume Discharge; Electronegative Seed Gas; Numerical Calculation; Chemistry Considerations

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

906
(PULSE GENERATORS; ENERGY STORAGE; INDUCTIVE)
(Systems; Systems)

TRIDENT-A MEGAVOLT PULSE GENERATOR USING INDUCTIVE ENERGY STORAGE
D. Conte, R.D. Ford, W.H. Lupton and I.M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 276-283
(06/1979).

A megavolt level pulse generator, TRIDENT, has been constructed utilizing an inductive store as the primary pulse forming device. The 2.5 microH coaxial storage inductor can be energized with up to 500 kA obtained from a 500 kJ, 60 kV capacitor bank. Current interruption is accomplished using a three stage opening switch comprised of an explosively actuated switch in parallel with two series switches. The generator has been operated at the 41.4 kA charge level (70% energy) to 2.5 MV peak with rise time of 150 nsec. Energy has been deposited into a 7.5 ohm resistive load at a rate of 5E10 W. Operation with optimized fuse dimensions and at full charge is anticipated to approach megavolt outputs at powers of 1E11 W. Future experiments include utilizing a homopolar generator as the current source. 7 Refs.

Primary Keywords: TRIDENT; Explosive Fuse; Exploding Wire; Design Considerations

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

907
USA-USSR INVESTIGATION OF 1200 KV TOWER INSULATION
(03/1980).

912
(PULSE GENERATORS)

(Trigger)

A 130 KV LOW IMPEDANCE MULTIPLE OUTPUT TRIGGER GENERATOR
A.H. Bushnell, C.B. Dobie and A.P. Krickhuhn
Maxwell Labs Inc, San Diego, CA 92123
2nd IEEE International Pulsed Power Conference Proceedings, pp 161-164
(06/1979).

A unique low impedance trigger generator has been developed which can generate 130 KV pulses having 22 ns rise time in four 50 ohm output cables. This generator uses a multichannel rail-gap switch to discharge a group of low inductance capacitors which are charged to 150 KV into the cutout cables. The performance of the circuit was analyzed using a computer and successfully predicted the behavior of the circuit. Time jitter between input trigger and output pulse is less than 2 ns (one standard deviation). The unit is immersed in oil in its own metal housing. 0 Refs.

Primary Keywords: Low Impedance; Four-output; High Voltage; Low Jitter

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

914
(POWER CONDITIONING)

(Pulse Transformers)

DESIGN OF PULSE TRANSFORMERS FOR PFL CHARGING

C.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 87-90
(06/1979).

Air core pulse transformers powered by low voltage capacitor banks can be simple efficient systems for charging high-voltage (0.5 to 3 MV) pulse forming transmission lines (PFL) such as those used in electron and ion beam accelerators. In these applications pulse transformers must have the combined capability of high voltage endurance and high energy transfer efficiency, particularly in repetitive pulse systems where these features are of primary importance. The design of shielded, high-voltage, spiral, strip, strip transformers which fulfill these requirements is described in this paper. Transformers of this type have been tested in three systems which operate with greater than 90 percent transfer efficiency and have not failed in over 1E7 shots. 6 Refs.

Primary Keywords: Air Core Pulse Transformer; Pulse Forming Line; Charging; Strip Transformer; High Efficiency

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

916

(SWITCHES; OPENING; SWITCHES; OPENING)

(Mechanical; Gas Gap; Magnetic Field)

DEVELOPMENT OF DISTRIBUTION AND SUBTRANSMISSION SF/SUB 6/ CIRCUIT BREAKER AND HYBRID TRANSMISSION INTERRUPTER

G.A. Votta, R.K. Smith, M.B. Engels and L.A. Nugent

Gould Inc, Colmar, PA 18915

EPRRI Report No. EPRRI-EL-810 (06/1978).

Availability: EPRRI-EL-810

EPRRI

Test models of the arc spinner interrupter were built and tested to determine the component requirements and arrangements necessary for the desired performance. A single-phase laboratory model of this interrupter was successfully tested up through 25 kA at 13.5 KV. Interruption of 40 kA at 13.5 KV was demonstrated; however, satisfactory performance was not obtained at significant current levels during this program when tested at higher voltages. A full-scale model of a three-phase outdoor distribution power circuit breaker rated 18 kA at 15.5 KV was built and successfully tested to standards. 34 Refs.

Primary Keywords: Spinner Interrupter; Hybrid Interrupter; Vacuum Interrupter; Performance Test

COPYRIGHT: 1978 EPRRI, REPRINTED WITH PERMISSION

917

(SWITCHES; CLOSING)

(Gas Gaps; Electrical)

HIGH REPETITION RATE MINIATURE TRIGGERED SPARK SWITCH

M.F. Rose and M.T. Glancy

Naval Surface Weapons Center, Dahlgren, VA 22448

2nd IEEE International Pulsed Power Conference Proceedings, pp 295-300
(06/1979).

A miniature triggered spark switch designed to operate at high repetition rates has been constructed. The device, along with associated trigger circuitry, has been incorporated into a simple L-C generator which produces an oscillatory discharge at a frequency of 150 MHz. The switch is operated in the pressure range 760 Torr - 2.6E3 Torr using commercial dry nitrogen as the working gas. Both brass and aluminum electrodes were investigated for repetition frequencies as high as 20 kHz and for gas flow rates as high as 8 cu. cm./sec. The effect of repetition rate on switch jitter and switch breakdown voltage is presented and discussed in terms of gas pressure and flow rate. 4 Refs.

Primary Keywords: Repetited; High Pressure; Quenching Spark Gap; Fast

Low Losses; L-C Oscillator

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

922
(INSULATION, MAGNETIC)

(
INFLUENCE OF NONUNIFORM EXTERNAL MAGNETIC FIELDS AND ANODE-CATHODE SHAPING ON MAGNETIC INSULATION IN COAXIAL TRANSMISSION LINES
M.A. Mostrom
Los Alamos National Lab., Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 475-478
(06/1979).

Coaxial transmission lines, used to transfer the high voltage pulse into the diode region of a relativistic electron beam generator, have been studied using the two-dimensional time-dependent fully relativistic and electromagnetic particle simulation code CCUBE. A simple theory of magnetic insulation that agrees well with simulation results for a straight cylindrical coax in a uniform external magnetic field is used to interpret the effects of anode-cathode shaping and nonuniform external magnetic fields. Loss of magnetic insulation appears to be mainly caused by satisfying two conditions: (1) the cathode surface should lie in the flux surface of the external magnetic field; (2) the anode should be shaped to insure that the magnetic insulation impedance, including transients, is always greater than the effective load impedance whenever there is an electron flow in the anode-cathode gap. 7 Refs.

Primary Keywords: Numerical Calculations; CCUBE; Simple Theory;

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

923
(POWER TRANSMISSION; INSULATION, MAGNETIC)

(
STEADY STATE NUMERICAL SOLUTION OF MAGNETICALLY INSULATED CHARGE FLOW

IN COAXIAL GEOMETRY
R.J. Barker and R.F. Ottlinger
Naval Research Lab., Washington, DC 20375
NPL Report No. NR-4554 (11/1981).
Availability: AD-A129473
NTIS

A vectorized, FORTRAN computer program has been written to calculate steady-state electron and ion fluxes as well as radial charge profiles for the magnetically insulated vacuum feed line parameters. The numerical formulation is derived in part from the theoretical treatment of the topic by K.D. Borgeron. However, it differs from the treatment in several important respects, including: a correction in one of the key scaling expressions, a restructuring of the boundary conditions to allow for specific parametric solutions, and a more careful consideration of the regions near the anode and cathode surfaces and near the electron sheath boundary. In deriving these results, analytic approximations for the fields in these 'special' regions were developed. These approximate solutions permitted numerical treatment of the singularities there. Matching the approximations between the regions also provides first-order guesses for the gross steady-state operating characteristics. 25 Refs.

Primary Keywords: Numerical Simulation; Charge Flow; Electron Flux;

Ion Flux; Radial Profile; Scaling

924
(BREAKDOWN STUDIES)

(
LIGHTNING)

LONG ARC SIMULATED LIGHTNING ATTACHMENT TESTING USING A 150 KW TESLA COIL
R.K. Golka
Munover AFB, Utah 84083
2nd IEEE International Pulsed Power Conference Proceedings, pp 136-141
(05/1979).

Recent advances in direct lightning strike testing have been in lightning attachment test techniques and generator development using very large Tesla Coil (50' feet wide). Breakthroughs in simulated lightning attachment to metallic aircraft airframe models which can be adapted to lightning operational aircraft models have been made in the past year. New high voltage long arc generator developments have succeeded in producing voltages in excess of 15 million volts and arc lengths in excess of 40 feet. The shortest path from the discharge arc electrode to the model exterior using the long arc does not govern the attachment points to the test specimen as it does when a short arc is used to conduct simulated lightning testing. The system just described may also have application as an ultra-high megavolt source for particle beam weaponry. 0 Refs.

Primary Keywords: Lightning Simulation; Pulse Generator; Attachment To Aircraft

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

925
(INSULATION, MAGNETIC)

(
)

MAGNETIC INSULATION IN SHORT COAXIAL VACUUM STRUCTURES

M.S. DiCicco and T.S. Sullivan
Physic International Co., San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 483-486
(06/1979).

Magnetically insulated vacuum structures (MIVS) can be used to overcome the limitation on power flow in liquid dielectrics and dielectric vacuums in pulsed high power accelerators. A short (1 mm), low-impedance ($Z_{\text{c}} \approx 5\text{ ohm}$) coaxial MIVS with a gap of 5 mm was studied experimentally. Power flows of $1.5 \times 10^6 \text{ W cm}^{-2}$ were observed. The current pulse showed some erosion before the onset of magnetic insulation. The transverse electron current arising from this erosion was observed with Faraday cups imbedded in the wall. Magnetic insulation was lost about 60-70 ns into the pulse. This loss was also observed in the Faraday cups and radiation diagnostics. This loss of magnetic insulation is associated with closure of the gap by cathode plasma. 8 Refs.

Primary Keywords: Vacuum Interface; Insulation Onset; Loss Calculations; Transverse Electron Current; Faraday Cup

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

927
(INSULATION, MAGNETIC)

(
MITL-A 2-D CODE TO INVESTIGATE ELECTRON FLOW THROUGH NON-UNIFORM FIELD REGIONS OF MAGNETICALLY INSULATED TRANSMISSION LINES
E.L. Neu and J.P. Vandevender
Sandia Labs, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 479-482
(04/1979).

Self-magnetically insulated, high voltage transmission lines are used in inertial confinement fusion particle accelerators to transmit power from the vacuum insulator to the diode. Injection and output convoluted sections pose special problems in establishing the desired electron flow pattern needed to maintain high overall efficiency. A time dependent 2-D numerical code for planar or triplane geometries calculates the motion of test particles through the convoluted or nuturn convolutes. The 1-D parapotential model is assumed to be accurate at each position and the magnetic field and potential distribution are calculated in the vicinity of the particle. The electric field is then calculated from Gauss's Law, and the electron motion is calculated relativistically. The results show that the electron canonical momentum in the direction of flow changes as the electron passes through a convoluted geometry. As shown by Merle, three electrons flow between the conductors after the convolute without re-intersecting the cathode. We hypothesize that these electrons lead to the losses observed in long self-magnetically insulated lines. Results of calculations are correlated with results of the MIT-L linear experiment. 9 Refs.

Primary Keywords: Electron Flow; Convolute Terminations; Numerical Calculation; Loss Calculation

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

928
(SWITCHES, CLOSING)

(
Gas Gaps, Electrical)

PARALLEL CONFIGURATIONS OF PRE-IONIZED LOW JITTER SPARK GAPS
W.A. Fitzsimmons and L.A. Rosocha
National Research Group, Madison, WI 53705
2nd IEEE International Pulsed Power Conference Proceedings, pp 184-186
(05/1979).

The properties of 10 to 30 kV four electrode field emission pre-ionized triggered spark gaps have been studied. A mid-plane off-axis trigger electrode is biased at $-V_{\text{c}}/2$, and a field emission point is located adjacent to and biased at the grounded cathode potential. Simultaneous application of a $-V_{\text{c}}/2$ of trigger pulse to both the electrodes results in the rapid sequential closing of the anode-trigger and trigger-cathode gaps. The observed jitter is about 1.5 ns. Parallel operation of these gaps (under 100 ns) connected in a common collector load has been studied. A simple theory that predicts the number of gaps that may be expected to operate in parallel is discussed. 0 Refs.

Primary Keywords: Four Electrode Field Emission Spark Gap; Triggering Considerations; Low Jitter; Parallel Operation

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

932
(SWITCHES, CLOSING)

(
Gas Gaps, Materials)

SURFACE AGING IN HIGH REPETITION RATE SPARK SWITCHES WITH ALUMINUM AND BRASS ELECTRODES
M.T. Glancy and M.F. Rose
Naval Surface Weapons Center, Dahlgren, VA 22468
2nd IEEE International Pulsed Power Conference Proceedings, pp 301-307
(05/1979).

The surface aging of the electrodes of miniature spark switches (Ad approximately 50) is explored using commercial dry nitrogen as the working gas. Both brass and aluminum electrodes were investigated for aging characteristics using a constant gas flow rate of 8 cu. cm. sec. . The gas pressure was varied from 760 torr-5200 torr. The switches were constructed as an integral part of a miniature L-C oscillator which has a ringing frequency of approximately 150 MHz. The aging process was halted at levels ranging from one to several thousand discharges and the electrode surface examined with a scanning electron microscope. 9 Refs.

Primary Keywords: Electrode Erosion; L-C Oscillator; Rep-rated; Surface Coatings; Electrode Preparation

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

936
(SWITCHES, CLOSING)

(
Gas Gaps, Materials)

ACOUSTIC PHENOMENA IN EROSION OF SPARK-GAP ELECTRODES

R.A. Petr and T.R. Burkes
Texas Tech Univ., Lubbock, TX
Applied Physics Letters, Vol. 36, No. 7, pp 536-539 (04/1980).

Experiments have been conducted to show that acoustic waves generated in the electrode material may cause an order-of-magnitude increase in the rate of electrode erosion. This increase is due to the arrival of reflected acoustic waves at the electrode surface during arc events. 7 Refs.

Primary Keywords: Arc Spots; Reflected Acoustic Waves; Increased Erosion Rate

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

942
(PULSE GENERATORS; PULSE GENERATORS)

(Mark I Line Type) A 500 KV REP-RATE MARX GENERATOR

J. Shearer
Maxwell Labs Inc., San Diego, CA 92123
2nd IEEE International Pulsed Power Conference Proceedings, pp 226-231
(05/1979).

An efficient PFN/Marx generator was constructed for generating high average power electron beams. The generator consists of ten 100 kV PFN stages connected in a Marx configuration. The Marx generator employs purged gas switches. The nominal operating parameters are: Voltage=500 kV, Current=10 kA, Pulse Duration=1 microsecond, Rep-Rate=100 Hz, Average Power=500 kW. This paper discusses the Marx charging power conditioning and the operation of the generator into resistive and electron beam loads. 1 Refs.

Primary Keywords: Pulse Forming Network; Marx Configuration; High Power; Gas Spark Gap; Rep-rate; Charging Considerations

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

943
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Recovery; Gas Gaps, Recovery)
GAS COOLING AND ELECTRIC STRENGTH RECOVERY AFTER A SPARK DISCHARGE
E.P. Bel'kov
Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 8, pp 1321-1323
(02/1972)

Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1678-1681 (August 1971)
Recovery of the electric strength of air gaps with a length $s =$ 2-10 mm after the passage of current pulses of 0.6-20 kA and 3-1500 microseconds long is investigated. The cooling of the gas following a spark discharge is investigated qualitatively by means of the shadow method. 4 Refs.
Primary Keywords: Gap Recovery; Air Gap; 20 kA Pulse; 1500 Microsecond Duration; Gas Cooling; Shadowgraph Diagnostic
COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

948
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Opt. Clos., Gas Gaps, Optical)
ELECTRON DENSITIES IN LASER-TRIGGERED SPARK GAP DISCHARGES
R.J. Crowley, R.F. Williams, M.A. Gundersen and A. Watson
Texas Tech University, Lubbock, TX 79449
2nd IEEE International Pulsed Power Conference Proceedings, pp 119-121
(06/1979)
The results of experiments designed to measure electron densities from measurements of Stark broadened spectral profiles in laser-triggered discharges in hydrogen are reported. Temporally and spatially resolved data have been obtained both during and after the arc for discharges in hydrogen. Evidence of a shockwave is presented, consistent with the observations of other investigators. 3 Refs.
Primary Keywords: Stark Broadening; Laser-triggering; Hydrogen Working Gas; Shock Wave
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

950
(PARTICLE BEAMS, ION)
(Generation)
HIGH-POWER ION BEAM GENERATION WITH AN INVERSE REFLEX TETRODE
J.A. Passer, R.A. Mohaffey, J. Golden and C.A. Kapetanakos
Naval Research Lab, Washington, DC 20375
Applied Physics Letters, Vol. 36, No. 8, pp 646-648 (04/1980).
A new reflexing-electron ion source is described. The device produces a unidirectional ion beam with relatively high efficiency even when the applied magnetic field exceeds the self-field. This new source operates at a low, constant impedance during much of the applied voltage pulse and is better matched to available high-power, low-impedance generators than previous reflexing-electron devices. Proton pulses with peak current approximately 500 kA have been produced with the inverse reflex tetrode coupled to the Gamble II generator. 15 Refs.
Primary Keywords: Reflex Triode; Low Impedance; Constant Impedance; Solid Cathode; 500 kA Output Current; Experiment; Theory
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

951
(PARTICLE BEAMS, ION)
(Generation)
ION BEAM GENERATION THROUGH A MOVING PLASMA BOUNDARY
M. Dembinski and P.K. John
University of Western Ontario, London, Ontario, Canada
2nd IEEE International Pulsed Power Conference Proceedings, pp 72-75
(06/1979).
It is shown that ion currents extracted from a moving plasma can be increased by a factor of approximately plasma velocity/acoustic speed as compared with a stationary plasma of the same density and temperature. A conical theta-pinch gun is used to accelerate plasma with density in approximately 10^{12} cm^{-3} to velocity $v = 10^7 \text{ cm/s}$. Total currents approximately 100 A of 10-20 keV ions were obtained from an 8 cm diameter extraction system. 7 Refs.
Primary Keywords: Moving Plasma; High Current; Child-Langmuir Law; Experiment
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

952
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
KRF LASER-TRIGGERED SF/SUB 6/ SPARK GAP FOR LOW-JITTER TIMING
W.R. Rooperton, J. Goldfarb, J.R. Murray and M. D'Addario
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 236
(06/1979).
An SF₆/sub 6/ spark gap operated at field stresses of 60-180 kV/cm can be triggered with subnanosecond jitter by volume breakdown in SF₆/sub 6/ induced by as little as 10 mJ in 15 ns of Krf laser radiation. 7 Refs.
Primary Keywords: Laser Triggering; Very Low Jitter
Secondary Keywords: Abstract Only
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

954
(BREAKDOWN STUDIES)
(Surface Flashover)
MECHANISM OF PULSED SURFACE FLASHOVER INVOLVING ELECTRON-STIMULATED DESORPTION
R.A. Anderson and J.F. Brainerd
Sandia Lab, Albuquerque, NM 87115
Journal of Applied Physics, Vol. 51, No. 3, pp 1614-1621 (03/1980).

A simple model is proposed to explain how a prebreakdown avalanche of secondary emission electrons can lead to surface flashover when an insulator in vacuum breaks down a few nanoseconds after high voltage is applied. The case of a plane insulator-vacuum interface perpendicular to parallel electrodes is considered. Positive surface charging is assumed to occur almost immediately upon application of the voltage, and the attendant secondary emission avalanche is assumed to be maintained at saturation throughout the prebreakdown time delay by field emission from the cathode electrode. Bombardment of the insulator by avalanche electrons desorbs a cloud of gas, which is partially ionized as it drifts through the swarm of electrons in the avalanche. The electric field at the cathode end of the insulator becomes enhanced as positive ions accumulated in the cloud in turn increases the field emission and the rates of gas desorption and ionization. This and other regenerative processes rapidly lead to breakdown.

Field emission from the cathode end of the insulator and increased field emission are individually considered in determining the prebreakdown time delay, with very similar results. The proportionality we have observed between the time delay and the inverse square of the applied voltage is also predicted, as well as a dependence of the time delay on the insulator length. The model may also account for the improved performance of insulators coated with corona metal oxides. 39 Refs.

Primary Keywords: Pulsed Surface Flashover; Prebreakdown Phenomena; Vacuum-insulator Interface; Surface Charge; Gas Cloud
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

956
(PARTICLE BEAMS, ELECTRON)
(Generation)
REPETITIVELY PULSED ELECTRON BEAM DIODE LIFETIME AND STABILITY
M.T. Buttram
Sandia Lab, Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 61-64
(05/1979).

Repetitively pulsed vacuum beam diodes will be required for most projected inertially confined fusion systems. Yet data on the operation of diodes under repetitive pulsing is sparse. This paper discusses the operation of a 250 KV, 1.5 kA/cm² diode at repetition rates to 30 Hz for sustained runs. Short term stability is typically 3 percent (standard deviation). Longer term there is a drift toward higher impedance at the start of the pulse. Details on this drift and a comparison of this process for a rather blunt versus a sharp cold cathode are presented. 1 Refs.
Primary Keywords: Vacuum Diode; Lifetime; Impedance Stability;
Repetitive
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

961
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SIMULATION OF INDUCTIVE AND ELECTROMAGNETIC EFFECTS ASSOCIATED WITH SINGLE AND MULTICHANNEL TRIGGERED SPARK GAPS
S. Levinson, E.E. Kurhardt, M. Kristiansen and A.M. Guenther
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 433-436
(06/1979).

When breakdown of a pressurized spark gap is initiated by a high power laser, a narrow spark channel is quickly established. In this case, the rise time of the current in the external circuit due to the breakdown of the gap is determined in a large measure by the inductive and electromagnetic effects associated with the channel dimensions and the resulting physical discontinuities. Experiments have been conducted using spark gaps where the discharge channel is simulated by a very thin wire. Current rise time measurements for various wire sizes (i.e., spark channel radius), wire position (i.e., on or off axis), and number of wires (i.e., multichanneling) have been carried out. The rise time values thus obtained agree quite well with the laser-triggered, single and multichannel, spark gap results. These results can be qualitatively explained using simple inductive circuits which dramatically underline the inductive character of the breakdown. The significance of these results in revealing the mechanism of spark gap breakdown will be discussed. 3 Refs.
Primary Keywords: Spark Channel Study; Simulation; Wires; Switch Inductance
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

962
(SWITCHES, CLOSING)
(Gas Gaps, Materials)
SPARK GAP EROSION RESULTS
R. Petr, D. Barrett and T.R. Burke
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 308-312
(06/1979).

The erosion characteristics of a spark gap with parallel-plane electrodes are determined at atmospheric and vacuum pressures. Erosion as loss of electrode material is measured in a range from 200 to 1000 amperes. The severity of electrode erosion is found to be related to spot formation, switching rate, melting point of the electrode, pressure, and gap length. Erosion values for a pulsed current are given for aluminum, brass, and carbon. 7 Refs.
Primary Keywords: Parallel-plane Electrodes; Low Current; Spot Formation; Switching Rate
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

968
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Mechanical; Vacuum, Electrical)

THE EFFECT OF GLASS DERRIS ON ELECTRON EMISSION AND ELECTRICAL BREAKDOWN OF VACUUM INTERRUPTERS

G.A. Ferrall and F.G. Hudda
General Electric Co., Schenectady, NY 12301
IEEE Transactions on Electrical Insulation, Vol. EI-15, No. 2, pp 61-67
(04/1980)

The breakdown electron emission and breakdown voltages have been studied for three experimental vacuum interrupters, two of which contained numerous glass particles the largest of which were typically 50 microns in their longest dimension. The contaminated interrupters differed from the uncontaminated interrupter in the following ways. 1) Continuously recorded Fowler-Nordheim plots had lower slopes and showed several stepwise changes in emission as the applied high voltage was varied. 2) 60 Hz breakdown voltages were lower and occurred randomly for sustained AC voltage at constant peak amplitude. 3) Electron emission current with DC high voltage applied was markedly sensitive to mechanical shock. Changes in emission occurred at statistically varying time intervals which may be several tens of milli-seconds from the imposed shock. We conclude that the presence of glass particles within the interrupter strongly alters the emission properties of highly stressed internal surfaces and significantly degrades dielectric capability. 7 Refs.

Primary Keywords: Vacuum Breakdown; Glass Debris; Vacuum Interrupters; DC Breakdown Voltages; Pre-breakdown Electron Emission; Degraded Dielectric Capability; Mechanical Shock Trials; Performance Degradation

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

969
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

ANALYSIS AND APPLICATION OF A TRANSFORMER CORE THAT ACTS AS AN ARC SNubber

J.H. Fink (1), W.R. Baker (2) and H.C. Owen (2)
(1) Brookhaven National Labs, Upton, NY
(2) Lawrence Berkeley Labs, Berkeley, CA
IEEE Transactions on Plasma Science, Vol. PS-8, No. 1, pp 33-38
(03/1980)

A series of equations is derived from which a transformer-core arc snubber can be designed. The theories used to derive these expressions are elaborations of previous studies of pulse-operated transformer cores. Some comparisons between theoretical and experimental results are given. 7 Refs.

Primary Keywords: Arc Snubber; Transformer Core; Eddy-current Losses; Residual Magnetization

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

973
(PARTICLE BEAMS, ELECTRON)

(Generation)

A COAXIAL E-BEAM EXCITATION SYSTEM FOR HIGH POWER EXCIMER LASERS

G.L. Oomen and W.J. Witteman
Twente Univ. Technology, Enschede, The Netherlands

Optics Communications, Vol. 32, No. 3 pp. 451-466 (03/1980).

The authors report operation of a medium scale, high current density (230 A/cm²) coaxial e-beam generator for excimer laser pumping. Construction is described and input and output energies are discussed. The specific input energy is found to be more than triple that of a single-sided transversal system, which is attributed to the absence of a foil support structure, a better concentration of energy, and extra electrons reflected by the potential field. 10 Refs.

Primary Keywords: E-beams; Coaxial generator; Uniform beam;

Construction details; Output energy

Secondary Keywords: Excimer laser pumping

COPYRIGHT: 1980 NORTH HOLLAND PUBLISHING CO.

987
(POWER TRANSMISSION)

(Transmission Lines)

HIGH POWER PULSE MODELING OF COAXIAL TRANSMISSION LINES

J.P. O'Loughlin
AFRL, Kirtland AFB, NM 87117
2nd IEEE International Pulsed Power Conference Proceedings, pp 96-95
(06/1979).

When coaxial cable is used for high voltage pulse transmission, a voltage transient appears on the outer sheath conductor. Although the magnitude of the transient is in the order of only a few per cent, this amounts to several kilovolts in some cases and must be carefully considered in terms of its effect on instrumentation, components and safety. To a first approximation, theoretically a coaxial cable should not develop any voltage on the outer sheath. A more refined analysis and model shows that the complete cancellation depends upon self-inductance of the sheath being exactly equal to the mutual inductance between the sheath and the center conductor. This condition is never exactly satisfied due to current distribution effects, even when the distribution is uniform and radially symmetric. The situation becomes worse when proximity effects are accounted for. The predicted sheath voltage agrees with experimental data within reasonable limits. 2 Refs.

Primary Keywords: Sheath Transient; Sheath Inductance; Proximity Effects

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

996
(PULSE GENERATORS)

(Trigger)

LIGHT ACTIVATED 10 KV LOW JITTER PULSER

J.D. Gilbreath
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 100-101
(06/1979).

An optically activated 10 kV pulser was designed to provide low jitter, long life, reliable triggering of ignitrons, triatrons, or midplane triggered spark gaps in high voltage electrically noisy environments. For midplane triggered spark gaps, a step-up transformer is also required. The input to a fibre optic cable is a 9.5 watt injection laser diode. The pulser detects and amplifies the fibre optic cable output to 10 kV. 0 Refs.

Primary Keywords: Low Input Power; Low Jitter; High Reliability

Secondary Keywords: Pulse Transformer

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

997
(SWITCHES, CLOSING)

(Solid Dielectric, Optic)

LOW JITTER, LOW INDUCTANCE SOLID DIELECTRIC SWITCHES

A.H. Guenther, D.M. Strickland and J.R. Battis
AFRL, Kirtland AFB, NM 87117

The Review of Scientific Instruments, Vol. 50, No. 11, pp 1487-1489
(11/1979).

It has been shown that the use of graded solid dielectric sandwiches in laser-triggered spark gaps (LTS) can lead to highly desirable multichannel operations while maintaining the low delay and jitter performance characteristics of LTS. As many as ten separate breakdown channels were observed when small circular or hexagonal aluminum inserts were inserted between two Mylar dielectric sheets stressed at 4.1 kV/mil. A reduction in rise time was noted for these multichannel switching events. 7 Refs.

Primary Keywords: Solid Dielectric Switch; Laser Triggering; Multichannel Operation; Low Jitter; Low Delay

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1007
(REVIEWS AND CONFERENCES)

(Prev. Edns)

PULSED HIGH-CURRENT ELECTRON TECHNOLOGY

G.A. Mesyats, Academy of Sciences of the USSR, Tomsk, USSR
2nd IEEE International Pulsed Power Conference Proceedings, pp 9-16
(06/1979).

The use of high-power pulse technology and explosive electron emission enables one to construct new pulsed electron devices. The present report gives the results of an intensive investigation of high-power pulse generation, electron beam geometry and the application of these beams to the production of ultra high frequency, laser and X-ray radiation. This report is based on results obtained at the Institute of High-Current Electronics. 25 Refs.

Primary Keywords: Pulse Generator; Spark Gap; Marx Generator; Module Approach; E-beam Accelerator; Rep-rate; Magnetic Insulation

Secondary Keywords: Gas Lasers

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1008

(POWER CONDITIONING)

(Pulse Forming Lines)

PULSE SHARPENING IN FERRITE TRANSMISSION LINES

M. Werner, ECOM, Fort Monmouth, NJ 07703

2nd IEEE International Pulsed Power Conference Proceedings, pp 91-95
(06/1979).

Pulse sharpening effects in ferrite transmission lines may be used to obtain kV pulses with ns rise time. The exact description of the sharpening effect requires complex shock wave analysis. In this paper an approximate but useful physical model is discussed. The ferrite is treated as a lossy but linear transmission line from which equivalent design results are obtained. In many instances the nonlinear effects presented are confined to a region which is small compared to the total transmission length, which makes the linear approximation more plausible. Preliminary experimental results, based on a 130 cm long line, are in accord with the predictions of the model. 4 Refs.

Primary Keywords: Fast Rise Time; Theory; Lossy, Linear Transmission Line; Experiment

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1011

(PULSE GENERATORS)

(IC)

HIGH REPETITION RATE LC OSCILLATOR

S.I. Moran, Naval Surface Warfare Center, Dahlgren, VA 22448

IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1524-1527
(10/1979).

LC oscillators have been built which can produce multi-kilowatt RF pulses in the megahertz frequency range with repetition rates of tens of Hz. The A and C for these oscillators can be determined from the frequency requirement and the high-Q requirements. The high repetition rates are achieved using a high-pressure spark-gap switch together with a DC to AC inverter power supply. Closely spaced antennae elements can be used to increase the number of cycles in the radiated waveform (radiated Q). 1 Refs.

Primary Keywords: LC Oscillator; High Q; Design Considerations,

Performance Test

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1049

(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)

(Systems, Systems)

NANOSECOND PULSE GENERATORS WITH INDUCTIVE STORAGE

Yu.A. Kotov, N.C. Kolganov, V.S. Sodol, B.M. Kovalevich and G.A. Mesyats, Academy of Sciences of the USSR, Tomsk, USSR

1976 IEEE Pulsed Power Conference Proceedings, Paper IA-1 (11/1976).

The exploding-wire is used for steepening the power in L-C circuit. The techniques of calculation of circuit with exploding wires is given as well as that of the calculation of the characteristics of inductive energy switching into resistive load. The high-current accelerators of electrons using this principle are also described. 39 Refs.

Primary Keywords: Inductive Energy Storage; Pulse Generator; Exploding Wire; Electron Accelerator

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

1050
(BREAKDOWN STUDIES)
(Plasma)

PLASMA ACCELERATION IN A COAXIAL INJECTOR WITH NONCYLINDRICAL ELECTRODES DRIVEN BY AN INDUCTIVE STORAGE DEVICE
E.A. Azuzov, I.V. Kichurov and M.M. Stepenenko
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Physics Technical Physics, Vol. 20, No. 9, pp 1160-1164
(09/1976).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 1826-1833
In experiments on plasma acceleration in a coaxial-conical injector driven by an inductive energy storage device under various conditions the peak current in the inductive storage device is 360 kA, the maximum injector current is 250 kA, and the initial pressure in the gas is varied over the range 1-10 torr. In front of the coaxial probe and electrical measurements chamber at pressures 0.1-10 torr quasi-steady contracting MHD plasma flow is established in the injector; this flow gives rise to a jet with $n/\text{cm}^3 \approx 2.10^{17} \text{ cm}^{-3}$, which is focused to a cross section 2 cm in diameter. The velocity is $6.4 \times 10^6 \text{ cm/sec}$ and the exit time is 5-14 μs . The rapid current decay due to the insufficient energy stored in the storage device (32 kJ) and the mismatch between the gas injection and the flow rate in the injector leads to a localization of the discharge near the electrode insulator and to the convection of the discharge into an arc. 7 Refs.

Primary Keywords: Coaxial Injector; Non-cylindrical Electrodes; Inductive Storage; High Energy Transformator Efficiency; Plasma Jet

COPYRIGHT: 1976 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1058
(SWITCHES; OPENING)
(Gas Discharge; Electron)

CIRCUIT BREAKER WITH SPACE DISCHARGE CONTROLLED BY ELECTRON BEAM
B.M. Kovalevskii and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
1975 IEEE Pulsed Power Conference Proceedings, Paper IC-7 (11/1976).
It is suggested that the space gap discharge controlled by the electron beam should be used to break the high current. The break of 150 kA occurs in 0.25 μs ; the beam current is 100 A. The break of 200 ns. 5 Refs.

Primary Keywords: E-beam; Controlled Opening Switch; Injected Beam; Thyratron; Detailed Analysis

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

1060
(BREAKDOWN STUDIES)
(Plasma)

ELECTRIC-DISCHARGE SF/SUB 6-/H/SUB 2/ LASER PUMPED BY AN INDUCTIVE STORAGE UNIT
A.F. Zapol'skii and K.R. Yushko
Soviet Journal of Quantum Electronics, Vol. 9, No. 2, pp 248-249
(02/1979).

Trans. From: Kvantovaya Elektronika, Vol. 6, pp 408-411, (Feb. 1979). 9 Refs.

Primary Keywords: Homogeneous Longitudinal Discharge; Non-ionized; SF₆/sub 6-/H₂/sub 2/ Plasma; Inductive Energy Storage
COPYRIGHT: 1979 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1063
(SWITCHES; OPENING)
(Mechanical)

FAST-ACTING ELECTRODYNAMIC CIRCUIT BREAKER
A.A. Rudenko, F.M. Spevakova, A.M. Stolov and A.D. Frolov
Scientific-Research Institute Of Electro-Physical Apparatus, Leningrad,
USSR
Instruments And Experimental Techniques, No. 2, pp 451-454 (04/1970).
Trans. From: Pribory i Tekhnika Ekspеримента 2, 124-127 (March-April 1970)

A device is described which reduces the circuit breaker current to practically zero within a definite time interval, while the opening of the circuit and the restoration of dielectric strength in the breaker take place within a time shorter than that interval. Discussed are the operating principle, the construction and the test results of a fast-acting circuit breaker which opens a circuit within 100 microseconds with a firing precision of 10 microseconds while a pulse power of 270 MW is dissipated in the resistive load. 1 Refs.

Primary Keywords: Operating Switch; 100 Microsecond Opening Time; Inductive Energy Storage; Capacitor Current Commutator

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

1078
(PARTICLE BEAMS; ELECTRON)

(Generation)
A COMPACT PULSED ELECTRON ACCELERATOR WITH AN INDEPENDENT POWER SUPPLY
Yu.V. Afanir, A.G. Ponomarenko, R.I. Goloukhin and Yu.I. Khapov
Institute Of Theoretical And Applied Mechanics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1310-1312
(10/1975).

Trans. From: Pribory i Tekhnika Ekspеримента 5, 20-22
(September-October 1975).

A compact pulsed electron accelerator having an independent power supply from a 12 V storage battery is described. The accelerating voltage of approximately 240 kV is formed by a pulse-voltage generator with a capacitive energy-storage device. The beam current is 4 kA. The length of a pulse is approximately 15 nsec. 8 Refs.

Primary Keywords: E-beam Generation; 15 ns Pulse Width; 240 kV Energy; 4 kA Beam Current; 12 V Primary Voltage Source

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

1087
(SWITCHES; CLOSING)
(Gas Gaps; Electrical)

A MULTISPARK HIGH-VOLTAGE TRIGATRON
V.G. Emelyanov, B.M. Kovalevskii, V.A. Lavrinovich, G.A. Mesyats and Yu.F. Petal'tsev
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 18, No. 4, pp 1114-1116
(03/1975). Trans. From: Pribory i Tekhnika Ekspеримента 4, 89-92 (July-August 1975)

A trigatron is described having a rated voltage of 400 kV and a nanosecond actuation-time stability over a wide range of working voltages, which allows firing of up to eight spark channels in one discharge gap. For a commutated current of 10 nsec and a double electrical length of the shaping line equal to 130 kA more than half of the energy in the storage device is lost in the commutator in the one-spark operating regime; for operation of eight channels the energy losses in the commutator do not exceed 10% of the energy stored in the storage device. 7 Refs.

Primary Keywords: Trigatron; 400 kV Operating Voltage; Multi-channel Operation; 10% Losses; Multiple Trigger

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

1090
(SWITCHES; CLOSING)
(Solid Dielectric; Electrical)

PPFAXIOM OF A SOLID-DIELECTRIC SWITCH
A.B. Andrejev, V.A. Burtsov and A.B. Prodnov
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics Technical Physics, Vol. 20, No. 2, pp 187-190 (02/1975)

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 294-300
An experimental study is reported of the time characteristics of a two-channel switch over broad ranges of working conditions. The basic dielectric material is polyethylene. A model of the controlled breakdown of the basic dielectric is proposed. Qualitative and in certain cases quantitative agreement is found between the calculated and measured data. The discrepancies are analyzed. 5 Refs.

Primary Keywords: Two Channel Switch; Time Characteristics; Polyethylene; Impact > 1066 A; $D/dt > 10^{12} \text{ A/sec}$

COPYRIGHT: 1975 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1095
(PARTICLE BEAMS; ION; PARTICLE BEAMS; ION; PARTICLE BEAMS, ION)

(Generation; Transport; Target Interactions)
TERMONUCLEAR MICRO-EXPLOSIONS WITH INTENSE ION BEAMS

F. Winterberg
University of Nevada System, Reno, NV 89507

Nature, Vol. 251, pp 44-46 (09/1974).

A method of generating intense ion beams using a magnetically insulated diode is presented. Theory predicts a current density of 3 kA/cm² and 1 MJ total delivered energy. Low ion velocities permit pulse shortening by time focusing. Two methods producing nuclear micro-explosions are discussed. 5 Refs.

Primary Keywords: Heavy Ion Beam; Vacuum Diode; Magnetic Insulation; Drift Tube; Spherical Symmetry

Secondary Keywords: Ion Beam Fusion

COPYRIGHT: 1974 MACMILLAN JOURNALS LTD.

1096
(SWITCHES; CLOSING; POWER CONDITIONING; PARTICLE BEAMS; ELECTRON)
(Thyatron; Pulse Transformers; Generation)
CURRENT SWITCHING IN TESLA TRANSFORMERS

A.A. Egoryev, V.S. Shirkov and S.M. Panasyuk
Novosibirsk Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, No. 4, pp 786-789 (08/1968).
Trans. From: Pribory i Tekhnika Ekspеримента 4, 26-30 (July-August 1968).

The authors describe the results obtained from studying hydrogen thyatrons working in the current commutator of a Tesla transformer. It is shown that the commutator, which consists of antiparallel thyatrons, makes it possible to decouple the current network in the beat halfperiod. This makes it possible to achieve energy regeneration and increase the efficiency of a direct current accelerator using a Tesla transformer. We also consider the use of inertial (mercury) high current tubes in the energy regeneration circuit for current commutation in a high-frequency circuit, in particular, in a Tesla transformer. 5 Refs.

Primary Keywords: Thyatron Switch; Tesla Transformer; High Efficiency; Electron Accelerator

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

1098
(BREAKDOWN STUDIES)

(Explosive Wires)
HOLOGRAPHIC INVESTIGATION OF ELECTRICAL EXPLOSIONS OF CONDUCTORS
E.I. Antonov, L.N. Gnatyuk, B.M. Stepanov, Yu.I. Filenko and V.Ye. Tserlin

High Temperature, Vol. 10, No. 6, pp 1087-1091 (12/1972).

Trans. From: Teplotizika Vysokikh Temperatur 10, 1210-1213 (November 1972).

Holography was used to study various stages of the explosions of wires in water. Estimates were obtained of the fragment velocity, the shock wave velocity and the electron density in the resultant plasma. The advantages of the holographic method over photography were identified. 6 Refs.

Primary Keywords: Hologram; Ruby Laser; Low-energy Explosion; Wire Fragmentation; High-energy Explosion; Wire Evaporation; Reconstructed Image

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

1099
(PULSE GENERATORS; SWITCHES; CLOSING; PARTICLE BEAMS, ELECTRON)

(Review; Pev Phys; Generation)

GENERATORS OF POWERFUL SUBNANOSECOND PULSES

B.M. Kovalevskii, A. Mesyats and V.O. Shpak

Academy of Sciences of the USSR, Tomsk, USSR
1975 IEEE Pulsed Power Conference Proceedings, Paper ID-5 (11/1976).

The authors relate the switching times of spark gaps to the amount of overvoltage and rate of voltage rise. They then proceed to show how these parameters can be tailored to switch a pulse generator with subnanosecond duration. A design is then presented for an electron accelerator utilizing this pulse generator that produces subnanosecond electron pulses with current densities greater than 10^6 A/cm². 10 Refs.

Primary Keywords: Pulse Generator; Subnanosecond Pulses; Static Breakdown; Pulse Breakdown; Very Fast Switching

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

- 1100
PULSE GENERATORS; SWITCHES; CLOSING
 (Capacitive; Gas Gaps; Self)
HIGH CURRENT SURFACESECOND PULSE GENERATOR
 B. M. Koval'chuk and G. A. Mesyats
 Tomsk Polytechnic Institute, Tomsk, USSR
 Instruments And Experimental Techniques, No. 5, pp 1362-1365 (10/1970).
 Trans. From: *Pribyr'i i Tekhnika Ekspertimenta* 5, 102-105
 (September/October 1970).
 This paper describes the design and performance of a current pulse generator having a pulse duration of 2.6 nsec at the half-amplitude point. The pulse amplitude is continuously variable from 50 to 1000 A with repetition rates up to 100 Hz. The basis of the work is a study of a gas avalanche commutator. 2 Refs.
 Primary Keywords: Pulse Generator; 50-1000 A Output Current; 2 nsec Charging Voltage; Switch Test; Gas Avalanche Discharge; Repetition Rate
 COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1105
SPARKDOWN STUDIES
 (Gas gap Discharge)
HIGH-POWER 1.33E ULTRAVIOLET RADIATION SOURCE FOR PUMPING OF GAS LASERS
 A. S. Barshov, P. G. Gor'kov, Yu. N. Drapkin, and A. B. Skvortsov
 FIAN, Lebedev Physics Institute, Academy of Sciences of the USSR,
 Moscow, 1959
 Soviet Journal Of Quantum Electronics, Vol. 6, No. 8, pp 994-996
 (02/1971).
 Trans. From: *Vysokotekhnika Elektronika*, Vol. 3, pp 1824-1826
 A pulsed high-current discharge ultraviolet radiation source was built. The length of the discharge gap was 93 cm and the stored energy was up to 1.3 kJ. The energy was released by the well-known surface-discharge method. The low resistance of the discharge gap made it easy to achieve a high-strike temperature, providing 5000 A current in the central region 20-30 cm when the ultraviolet pulse energy was about 1.3 kJ. The ultraviolet pulse surface discharge low voltage was about 1.5 kV after pulse. Surface Discharge Low Voltage; Induced Charge; Ion Current; Plasma; 250 nm UV Pulse
 COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 1120
SWITCHES; CLOSING
 (Gas Gaps; Electrical)
PLASMA TRIGATRON SPARK GAP
 V. V. Barabashkin
 Tomsk Polytechnic Institute, Tomsk, USSR
 Instruments And Experimental Techniques, Vol. 20, No. 2, pp 472-474
 (04/1977).
 Trans. From: *Pribyr'i i Tekhnika Ekspertimenta* 2, 131-132 (March-April 1977).
 A trigatron spark gap which works at atmospheric pressure is described. The gap is capable of switching currents of up to 100 A over a wide range of voltages. It is shown that for breakdown voltages across the main gap of 10-35 kV, the time interval between the beginning of the trigger pulse and the beginning of the current pulse in the main gap depends monotonically on the working voltage and may reach 30 microseconds. 5 Refs.
 Primary Keywords: Spark Gap; Trigatron Gap; 10-35 kV Operating Voltage; 10 kA Current; 30 Microsecond Switching Delay
 COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1133
REVIEWS AND CONFERENCES; ENERGY STORAGE; PULSE GENERATORS
 (Reviews; Reviews; Reviews)
TECHNOLOGY OF LARGE IMPULSE CURRENTS AND MAGNETIC FIELDS
 V. S. Komel'kov
 FID Report No. FID-MI-24-992-71 (12/1971).
 Trans. From: *Tekhnika Bol'sishikh Impul'snykh Tokov I Magnitnykh Polej*. Atomizdat, Moscow, 1-472 (1970).
 Availability: AD 736910 NTIS
 This book furnishes diagrams, calculation methods, characteristics, and designs of power capacitor batteries and their basic elements: capacitors, various types of spark gaps (vacuum, high pressure, solid dielectric), insulation of junction circuits (busbars, cables), and pulse transformers. Methods of calculating magnetic fields, as well as inductance in solenoids and conductors, are given. The design and behavior of metals in superstrong magnetic fields are examined. Orig. art. has: 205 figures; 34 tables. 268 Refs.
 Primary Keywords: Energy Storage; Capacitor; Homopolar Generator; Inductor; Switch; Spark Gap; Insulation; Design Considerations; Power Transmission
- 1135
(PULSE GENERATORS)
 (Line Type)
HIGH-VOLTAGE PULSER DEVELOPMENT
 H. Watson
 AiResearch Co., Torrance, CA 90509
 IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1518-1527
 (10/1979).
 This paper highlights the development of a pulse generator that utilizes a single, midplane, triggered spark gap (TSG) to discharge a pulse-forming network (PFN) into a CS/sub 2/ laser cavity load. The PFN is a four-section line pulser. When charged to 116 kV, it can discharge 300 J in 700 ns full width half maximum (FWHM). The system operates at up to 500 pps. In designing the TSG inductors, the pulse rise time was kept long enough to prevent excessive ringing in the output cables. Such ringing can cause arcing in the vicinity of damage to the cables themselves. The PEV capacitors were potted into a coaxial configuration to minimize inductance. As the pulse repetition rate increases or the charge duration decreases, special consideration must be given to design of the midplane TSG voltage grading network to ensure the triggered electrode always stays at some set fraction of the FWHM voltage during charge. This paper describes a circuit that makes operation of the grading network independent of frequency and charge duration, within certain limits. Tests were run in synthetic air and in nitrogen to evaluate operating voltage and the amount of jitter and misfire as a function of pressure. 4 Refs.
 Primary Keywords: Pulse Forming Network; Spark Gap; Trigger Voltage Grading Network; Reprinted; Performance Test
 COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION
- 1137
(PARTICLE BEAMS; ELECTRON; PULSE GENERATORS)
 (Generation; Blumlein Lines)
'WFT-JET' HIGH-CURRENT PULSED RELATIVISTIC-ELECTRON ACCELERATOR
 S. S. Kinszen, O. P. Makasimov, Yu. L. Sidorenko, V. P. Smirnov and A. M. Spector
 Instruments And Experimental Techniques, Vol. 16, No. 2, pp 364-366
 (04/1973).
 Trans. From: *Pribyr'i i Tekhnika Ekspertimenta* 2, 26-28 (March-April 1973).
 A pulsed high-current electron accelerator having a beam current I = 10-30 kA and an electron energy E = 0.5-1 MeV is described. A pulse having a length of approximately 40 nsec with a trapezoidal Blumlein strip line which utilized a deformed rectangular waveguide as the dielectric. The deforming of the line was achieved by means of two stepped SIN-60°-25% pulse generators connected in series. 5 Refs.
 Primary Keywords: Blumlein Line; Field Emission Diode; Sliding Discharge; 1 MV Operating Voltage
 COPYRIGHT: 1973 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1145
(SWITCHES; CLOSING)
 (Gas Gaps; Optical)
COMMUTATION OF SPARK GAPS BY MEANS OF A PULSED GAS LASER OPERATING IN THE ULTRAVIOLET RANGE
 E. A. Lenberg, Yu. V. Tkach, I. I. Magda, N. P. Gadetskii and V. U. Abramovich
 Physico-Technical Institute, Academy of Sciences of the Ukrainian SSR,
 Kiev, USSR
 Instruments And Experimental Techniques, Vol. 16, No. 1, pp 165-167
 (02/1973).
 Trans. From: *Pribyr'i i Tekhnika Ekspertimenta* 16, 140-142
 (January-February 1973).
 The use of a pulsed ultraviolet laser based on molecular nitrogen, which generates radiation having a wavelength 3371 angstroms and a power of 10 kW, allowed two air spark gaps to be fired at a frequency of 15 to 20 Hz. Synchronization of breakdown within at most 1 nsec was achieved. The dependencies of the operate time of the spark gap on applied voltage are presented for various lengths of the spark gap for laser initiation. 3 Refs.
 Primary Keywords: Nitrogen Laser; Multiple-gap Triggering; Field Distortion; Cathode Target Electrode
 Secondary Keywords: Water Gap
 COPYRIGHT: 1973 PLENUM PUBLISHING CORP., REPRINTED WITH PERMISSION
- 1146
(SWITCHES; CLOSING)
 (Thytrons)
CONTROLLED GAS DISCHARGE SWITCH WITH A COLD CATHODE
 G. I. Nosov and S. A. Smirnov
 Khar'kov Institute Of Radioelectronics, USSR
 Instruments And Experimental Techniques, Vol. 20, No. 4, pp 1147-1149
 (08/1977).
 Trans. From: *Pribyr'i i Tekhnika Ekspertimenta* 4, 206-208 (July-August 1977).
 A sealed-off metal-ceramic controlled gas-discharge low-pressure switch with a cold hollow metal cathode operating at a voltage of 0.4-0.5 kV and a dc load. The switch is filled with He at 2.5 atm, a working pressure of 1.2-0.3 torr. The device can operate in two modes: in a single mode with a pulsed current of up to 30 kA, and in a frequency mode with a current of 2 kA for a frequency of the construction of the pulses of up to 100 pulses/sec. The device operating delay time is <0.4 microsecond, and the periodic instability of this time is <0.10 nsec. 6 Refs.
 Primary Keywords: Ion Pressure Discharge Tube; Hydrogen Gas; 30 kV Operating Voltage; 3 kA Peak Current
 COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1153
(SWITCHES; CLOSING)
 (Gas Gaps; Self)
HIGH VOLTAGE MEGA-AMP ARC GAP WITH DESTRUCTIBLE ELECTRODES
 G. S. Vil'evich, V. N. Karasyuk and G. I. Sil'vestrov
 Institute Of Nuclear Physics, Academy of Sciences of the USSR,
 Novosibirsk, USSR
 Instruments And Experimental Techniques, Vol. 21, No. 1, pp 76-79
 (02/1978).
 Trans. From: *Pribyr'i i Tekhnika Ekspertimenta* 1, 75-77
 (January-February 1978).
 Two low-inductance two-electrode arc-gap constructions of mega-amp rating are described in which one or both electrodes have the form of plates that are destroyed on passage of the current pulse. Efficient removal of electric erosion products from the working volume of the arc gap is assured and shock loads on the stationary elements of the construction are reduced as a result. The arc gaps are filled with nitrogen to a pressure of 10-15 atm. At a working voltage of 50 kV the inductance of the arc gap does not exceed 8 nH. 3 Refs.
 Primary Keywords: Two-electrode Spark Gap; Single Shot Operation; Shot-to-shot Electrode Replacement; 50 kV Operating Voltage; 1 MA Current; 8 nH Inductance
 COPYRIGHT: 1978 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1157
(SWITCHES; CLOSING)
 (Gas Gaps; Electrical)
NEW HIGH-POWER NANOSECOND SWITCH
 P. A. Vorob'ev, G. A. Mesyats and Yu. F. Potolitsyn
 Tomsk Polytechnic Institute, Tomsk, USSR
 Sov. J. Physics-Tech. Physics, Vol. 11, No. 8, pp 1114-1119
 (02/1967).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 36, 1492-1498 (August 1966).
 A nanosecond switch has been developed which has a wide range of working voltages, a stable delay between the triggering and operating voltages, and a nanosecond switching time; it can be triggered by a pul of small amplitude. 6 Refs.
 Primary Keywords: Spark Gap; Series-connected; Low Delay; Low Jitter; Low Trigger Voltage
 COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1160
(PARTICLE BEAMS, ELECTRON)
(Generation)

PRODUCTION OF AN INTENSE ELECTRON BEAM

V. Legunov, A. Ponomarenko and L. Fominskii
Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics Technical Physics, Vol. 17, No. 9, pp 1560-1567
(03/1972).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 42, No. 9, pp 1947-1957
Experimental results are presented on the focusing of an electron beam (300 keV and 3 kA, and pulse length 10⁻⁷ sec), obtained with a field-emission length cathode. The current density is 10⁶A/cm². A method of measuring the beam parameters is described. These include current, electron energy spectrum, the beam configuration in the focusing magnetic field, and the total energy transported by the beam. The effect of the plasma in the accelerating gap on the operation of the vacuum diode and on beam focusing is discussed. 17 Refs.

Primary Keywords: Focused Beam; Beam Parameter Measurements; 300keV, 3kA, 10⁻⁷ Pulse Length

COPYRIGHT: 1973 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1162
(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

THE AT-100-A CONTROLLED PLASMA-CATHODE GAS-DISCHARGE DEVICE

L.N. Vagin and L.G. Ivleva
Instruments And Experimental Techniques, No. 6, pp 1448-1451 (12/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 157-161
(November-December 1968)

The possibility of constructing a controlled plasma-cathode gas-discharge device, which as the author's is demonstrated experimentally, has a low discharge plasma responsible for correctly between the working electrode. Freedom from positive wear of the negative working electrode facilitates the design of high-current gas devices capable of protracted service over a wide range of operating voltages. A metal-ceramic anode with a maximum operating current of 4 kA was devised. The range of anode operating voltages runs from 0.2 to 22 kV. The device is filled with hydrogen to a pressure of 5.5 torr. 6 Refs.

Primary Keywords: Anode; Gas Discharge Switch; Thyatron-like Behavior; Hydrogen Gas; Plasma Cathode

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

1164
(SWITCHES, CLOSING)

(Gas Gaps, Crossed-field)

THE TRIOTRON-A CONTROLLABLE DEVICE WITH CROSSED FIELDS

A.I. Vishnevskii, L.P. Pavlenko, A.I. Soldatenko and A.I. Shandakov
Kiev Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 14, No. 3, pp 847-848
(06/1971).

Trans. From: Pribory i Tekhnika Eksperimenta 3, 165-166 (May-June 1971)
The possibility of creating a controllable gas-discharge device having a cold cathode and a constant magnetic field was shown experimentally. The ignition of the discharge between the main electrodes was determined by a positive potential applied to the control electrode. The cold cathode allowed powerful devices (10 to 20 kA) to be created which were capable of prolonged operation in the voltage range from 0.4 to 3.5 kV. The device was filled with H/sub 2/ up to a pressure of 10⁻² Torr. 1 Refs.

Primary Keywords: Triotronic; Crossed-field Closing Switch; Electrical Starting; Low Delay

COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION

1167
(PARTICLE BEAMS, ELECTRON)

(Generation)

ACCELERATOR MODULE OF 'ANGARA-5'

S.V. Besenkov, O.A. Gusev, Yu.A. Istomin, Ju.V. Koba, G.M. Letmanova, A.M. Pesechnikov, B.P. Pevchev, D.P. Pecherskiy, A.S. Perlin, L.I. Rudakov, V.P. Smirnov, V.I. Chetvertkov and I.R. Jampols'kiy
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
2nd IEEE International Pulsed Power Conference Proceedings, pp 25-30
(06/1970).

Features and design principles of the inertial confinement fusion multi-module 'Angara-5' accelerator are considered. The computed output parameters of an individual module are as follows: U=1 MeV; I=0.8 MA; τ =90 ns; W=102 kJ. The predicted output was compared with the pulsed-shaping line rock-up measurements. According to these measurements the end-on section contributes 21 percent of the total pulse-shaping line capacitor in computations via transmission line sections with appropriate impedance values. The reasonable choice of the pulsed-shaping equivalent circuit was confirmed by experimental data and were in good agreement with calculations based on system design features. 9 Refs.

Primary Keywords: E-beam Accelerator; High Voltage; High Power; Low Frequency; Modular Approach

COPYRIGHT: 1970 IEEE, REPRINTED WITH PERMISSION

1179
(BREAKDOWN STUDIES)

(Gas, Electric)

CYLINDRICAL CHANNEL IN A HIGH-CURRENT DISCHARGE IN AIR

A. Pavlovskii, G. Karbov, G. Katreev, N. Leonava and E. Smirnov
Affiliation Not Given
Soviet Physics Technical Physics, Vol. 20, No. 2, pp 182-186 (08/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 286-293
An experimental study of a high-current pulsed cylindrical discharge in air is reported. The discharge is initiated by the electrical breakdown of a thin conductor; the current reaches 500 kA and the pulse length reaches 150 us. The system of magnetohydrodynamic equations with a nonlinear thermal conductivity which describes the expansion of the discharge channel is analyzed. The results of a numerical calculation for a small magnetic Reynolds number are reported. The effects of magnetic pressure and radiation diffusion on the channel expansion velocity are analyzed. It is shown that the motion of the current boundary of the channel can be simulated by the process of heat propagation through a fixed gas. This approach is used to obtain a self-similar solution for the expansion of a high-current discharge channel. 12 Refs.

Primary Keywords: Exploding Wire; 500 kA Peak; 150us Pulse Length; High Current Discharge Channel; Heat Propagation Model

COPYRIGHT: 1975 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1186
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

ELECTRICAL BREAKDOWN OF VACUUM GAPS UNDER SUPERHIGH VOLTAGE PULSES

I.I. Kavintskii, G.M. Kassirov and G.V. Emirov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Techical Phys. Vol. 19, No. 11, pp 1424-1435
(10/1974).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 2326-2328 (November 1974)
Extra-metallic results are reported for electrical breakdown of centimeter vacuum gaps under superhigh voltage pulses. At distances up to 15 cm the breakdown field across the cathodes is virtually constant, and the processes leading to the breakdown occur in short time intervals. In the microsecond time range the breakdown voltage is independent of the pressure and species of the residual gas. 4 Refs.

Primary Keywords: Vacuum Breakdown; Very Large Overvoltage; Low Delay; 15 cm Gap; Residual Gas Effect; Voltage Measurement

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1187
(BREAKDOWN STUDIES; SWITCHES, OPENING)

(Excluding Wire, Explosive Fuses)

ELECTRICAL EXPLOSION OF FOILS. II

V.A. Burtsev, V.N. Litunovskii and V.F. Prokopenko
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Techical Physics, Vol. 22, No. 8, pp 957-961 (08/1977).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1653-1661 (August 1977)
Experimental results on electrical explosions of foils in solid, liquid, and friable media are reported. The results are compared with data obtained in a study of explosions of foils in air. Synthetic quartz dust is found to be the most suitable of the media studied for use in microsecond foil current breakers. 7 Refs.

Primary Keywords: Exploding Foil; Solid Environment; Liquid Environment; Synthetic Quartz Dust; Opening Switch

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1188
(BREAKDOWN STUDIES; SWITCHES, OPENING)

(Excluding Wire, Explosive Fuses)

ELECTRICAL EXPLOSION OF FOILS. I

V.A. Burtsev, V.N. Litunovskii and V.F. Prokopenko
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Techical Physics, Vol. 22, No. 8, pp 950-956 (08/1977).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1642-1652 (August 1977)
The electrical explosion of plane foils is studied experimentally, and the results are used to formulate a mechanism for the operation of fast high-current foil current breakers. The explosions occur in air, so that optical methods can be used to observe the explosion process and the formation of the high-current shunt discharge. There are edge effects which result in dielectric breakdown of the gap and in the formation of a discharge channel before the foil explosion is completed. The electrical measurements are discussed. These measurements confirm the effect of anomalous behavior in the explosion at high energy injection rates. 12 Refs.

Primary Keywords: Exploding Foil; Opening Switch; Air Environment; Optical Diagnostics; Edge Effects; Spark Channel

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1197
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

HIGH PULSED MAGNETIC FIELDS FOR NUCLEAR FUEL ROD SEALING

A.M. Andrianov, V.F. Demchuk, G.A. Eliseev and P.A. Levit
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
1974 IEEE Pulsed Power Conference Proceedings, Paper III-E-10 (11/1976).

The technique and technology have been developed at the I.V. Kurchatov Institute of sealing the nuclear fuel rod claddings with high pulsed magnetic fields. The process of bonding the materials by magnetic pulsed sealing technique is of a dynamic character. A metal-to-metal bond is formed when a fuel rod cladding collapses at high impact velocities and impacts upon itself or onto a special plug. In this process the magnetic field serves as an energy source to deform the cladding. The sealing process is very short (some microseconds) and the metal does not melt during the process. The main problem in the pulsed magnetic technology is the development of stably coils, which could produce with a good reproduction high pulsed magnetic field intensities of which are much higher than those necessary for coil forming. A frequency must also be rather high because the fuel rod claddings are generally thin-walled and are made of low-conductivity materials (zirconium alloys). Capacitor banks are generally used as current generators for pulsed magnetic machines. To provide the high frequency of a discharge current the machine electrical circuit must be of a low inductance. Thus there are special requirements on pulsed magnetic machine units: capacitors, switches, busbars, and inductors. The shape of a discharge current in a coil machine is closer than that of a damped sine wave. 9 Refs.

Primary Keywords: Magnetic Field; High Field; Stable Coils; High Frequency; Capacitor Bank

Secondary Keywords: Nuclear Fuel Rod Sealing

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

1207
(SWITCHES, CLOSING)

(Mechanical)

MULTICHANNEL HIGH-CURRENT PULSED COMMUTATOR

R.D. Ziganшин and A.P. Gagarin
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 475-476
(04/1977).

Trans. From: Pribory i Tekhnika Eksperimenta 2, 133-134 (March-April 1977)

The commutator described enables one of two pulsed loads to be alternately connected to a capacitor tank. The number of parallel-pulse channels of each load is 200, and the amplitude of the current through each channel during each pulse is 10 kA. The commutator is convenient to operate and to service. 2 Refs.

Primary Keywords: Closing Switch; Mechanical Switch; 1.5 kJ Capacitor Banks; Two Loads; Load Switching; 1.5 ns Pulse Duration

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

1223
(POWER CONDITIONING)
(Pulse Forming Lines)
LOW-IMPEDANCE HIGH-VOLTAGE PULSERS FOR TRAVELLING-WAVE EXCITATION OF
HIGH-POWER UV GAS LASERS

H.M. Von Bergmann and V. Hasson
Optical Sciences Div., NPRL, CSIR, Pretoria 0001, South Africa
Journal Of Physics E: Scientific Instruments, Vol. 9, pp 982-984
(11/1976).

The authors describe the design of a simple and novel travelling-wave-type pulsing system suitable for transverse discharge excitation of high-power UV gas lasers. The pulsers have been used to excite high-pressure nitrogen lasers at 337.1 nm with effective inversion lifetimes of <1 ns. The beam powers exceed 2 MW. 7 Refs.

Primary Keywords: Stripline; Pulse Forming Line; 45 kV Operating Voltage.

Secondary Keywords: Gas Laser; Pumping; Travelling Wave Pulser

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1227
(ENERGY STORAGE, INDUCTIVE)
(Systems)

SUPERCONDUCTING INDUCTIVE ENERGY STORAGE UNIT FOR LASER PUMPING SYSTEMS
B. Vuj, V. Karasik, R. Kopylovskii, G. Kurganov, V. Vysetskii, D. Pronkin, Y. Ffimov and G. Agapov
Academy of Sciences of the USSR, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 4, No. 9, pp 1099-1101
(03 1975).

Trans. From: Kvantovaya Elektronika, Vol. 1, pp 1983-1987
A description is given of a high voltage pulsed superconducting inductive energy storage unit intended as a power supply source for laser pumping systems. 6 Refs.

Primary Keywords: Helium Cooled Storage Element; Cryostat; Current Leads; Electrical Power Supply; Current Switching System; Gas Discharge Lamp (20kJ/pulse)

COPYRIGHT: 1975 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1226
(DIAGNOSTICS AND INSTRUMENTATION)

(Current) MAGNETOOPTICAL CURRENT TRANSFORMER. 2: COMPONENTS
H. Aulich, W. Beck, M. Douklas, H. Harms, A. Papp and H. Schneider
Siemens AG, Munchen, FRG

Applied Optics, Vol. 19, No. 22 pp. 3735-3740 (11/1980).
A general overview of the requirements for the components of the transformer is given. The optical fiber, the coil former, the light source, and the signal processing circuit are discussed in detail with a view towards actual devices that could be used. 16 Refs.

Primary Keywords: Magnetooptical Current Transformers; Components; Light Source; Signal Processing; Optical Fiber

COPYRIGHT: 1980 OPTICAL SOCIETY OF AMERICA

1227
(DIAGNOSTICS AND INSTRUMENTATION)

(Current) MAGNETOOPTICAL CURRENT TRANSFORMER. 3: MEASUREMENTS
H. Harms and A. Papp
Siemens AG, Munchen, FRG

Applied Optics, Vol. 19, No. 22 pp. 3741-3745 (11/1980).
The authors describe the magnetooptical current transformer they set up. Measurements of currents were taken over a range of 50-120A at both room temperature and over a range of temperatures from -20 to +45 degrees Celsius. At room temperature an accuracy of 0.2% was obtained, while the accuracy was somewhat less over the range of temperatures. 4 Refs.

Primary Keywords: Magnetooptical Current Transformer; Measurements; Very High Accuracy

COPYRIGHT: 1980 OPTICAL SOCIETY OF AMERICA

1228
(BREAKDOWN STUDIES)

(Gas, Electrical) ANALYSIS OF THE ANODE BOUNDARY LAYER OF HIGH INTENSITY ARCS

H.A. Dinulescu and E. Pfender
University of Minnesota, Minneapolis, MN
Journal Of Applied Physics, Vol. 51, No. 6, pp 3149-3157 (06/1980).
A one-dimensional analysis of the anode boundary layer of an atmospheric pressure, high intensity argon arc reveals substantial deviations from local thermodynamic equilibrium (LTE) in this layer. The temperature of the heavy species approaches the temperature of the anode in the immediate vicinity of the anode surface. Whereas the electron temperature remains sufficiently high to ensure the required electrical conductivity, temperature and density gradients in the anode boundary layer contribute substantially to the electric current flow so that the potential drop across the boundary layer becomes negative. The main voltage drop, which is in the order of 1 V, is essentially confined to the sheath at the bottom of the boundary layer overlying the anode surface. The thickness of this sheath is several orders of magnitude smaller than the anode boundary layer, and the potential drop in the sheath is also negative. Therefore, the anode fall becomes negative for the entire parameter range covered in this paper, in contrast to the results of previous theories. This finding affects the anode energy balance as well as the interpretations of indirect (colorimetric) anode fall measurements which is important for the design of arc gas heaters. 17 Refs.

Primary Keywords: Argon Arc; Boundary Layer; Negative Potential Drop

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1229
(BREAKDOWN STUDIES)
(Gas, Electrical)

MODELING OF THE ANODE CONTRACTION REGION OF HIGH INTENSITY ARCS

D.M. Chen and E. Pfender
University of Minnesota, Minneapolis, MN

IEEE TRANS PLAS SCI, Vol. PS-8, No. 3 pp. 252-259 (09/1980).

A self-consistent model for the anode contraction region of a high intensity DC arc is based on a wall stabilized axisymmetric arc operated at atmospheric pressure with a plane cooled nonablating anode perpendicular to the arc axis. Arc contraction is in front of the anode very similar to that of cold gas from the vicinity of the anode leading to a more or less pronounced anode jet. The conservation equations for the anode region represent a set of highly nonlinear integro-differential equations which describe the temperature and the flow field in the arc. Numerical solutions of these equations are obtained by using an iterative finite-difference method. Results for a nitrogen arc at 250 A indicate that heat transfer close to the anode is dominated by the electron enthalpy transport. The cold gas approaches the arc fringes with velocities in the order of 1 m/s, and reaches velocities of up to 250 m/s in the hot core of the arc, indicating the existence of an anode jet which has not been confirmed by experimental investigations. 16 Refs.

Primary Keywords: Anode Contraction Region; Anode Jet; Arc Temperature; Arc Flow Field; Self-magnetic Field

Secondary Keywords: Numerical Results; Boundary Conditions; Potential Profile

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

1230
(PARTICLE BEAMS, ION)

(Reviews)

NPL LIGHT ION BEAM RESEARCH FOR INERTIAL CONFINEMENT FUSION
G. Cooperstein, S.A. Goldstein, D. Mosher, R.J. Barker, J.R. Boller,
D.G. Colombe, A. Drabot, R.A. Meger, W.F. Olophant, P.F. Ottlinger,
F.L. Sandel, J. Stephanakis and F.C. Young
Naval Research Lab, Washington, DC 20375
NPL Memorandum Report No. 4387 (11/1980).

Availability: AD A029471

NTIS

There is presently great interest in using light ion beams to drive thermonuclear pellets. Terawatt-level ion beams have been efficiently produced using conventional pulsed power generators at Sandia Laboratory with magnetically-insulated ion diodes and at the Naval Research Laboratory with pinch-reflex ion diodes. Both laboratories have recently focused ion beams to pellet dimensions. This paper reviews recent advances made at NPL in the area of ion production with pinch-reflex diodes, and in the areas of beam focusing and transport. In addition, modular generator and beam requirements for pellet ignition systems are reviewed and compared with the latest experimental results. These results include the following: (1) production of greater than 100 kJ proton and deuteron beams with peak ion powers approaching 2 TW on the PITMON generator in collaboration with Physics International Co., (2) focusing of 0.5 TW deuterium beams produced on the NRL Gamble II generator to current densities of about 300 kA/cm², and (3) efficient transport of 100 kA level ion beams over 1 meter distances using Z-discharge plasma channels. 28 Refs.

Primary Keywords: Intense Light Ion Beams; Ion Beam Focusing; Ion Beam Transport

Secondary Keywords: Inertial Confinement Fusion; Charged Particle Beam Fusion

1231
(PARTICLE BEAMS, ELECTRON)

(Target Interactions)

RADIATION FROM RELATIVISTIC ELECTRONS IN A MAGNETIC WIGGLER
A.N. Didenko, A.V. Kozhevnikov, A.F. Medvedev, M.M. Nikitin and V.Ye. Epp

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics JETP, Vol. 49, No. 6, pp 973-979 (06/1979).

Trans. From: Zh. Eksp. Teor. Fiz. 76, pp 1919-1932 (June 1979).
The spectral and polarization properties of wiggler radiation of relativistic electrons have been investigated theoretically and experimentally as a function of angle in the optical region of the spectrum for motion of the electrons in a plane magnetic wiggler installed in the ring of an electron synchrotron. The properties of the first and second harmonics of the radiation are discussed. It is shown that the polarization-angular characteristics of the first harmonic of the wiggler radiation coincide with those of instantaneous synchrotron radiation; the influence of longitudinal oscillations of the electron in the wiggler on the polarization properties of the second harmonic radiation is also shown. The appreciable influence of the angular spread of the electron beam on the spectral-angular distribution of the wiggler radiation is established experimentally. The good agreement of the experimental results with the theory opens up the possibility of further use of wiggler radiation for solution of a wide range of scientific and applied problems. 32 Refs.

Primary Keywords: Relativistic E-beam; Magnetic Wigglers; Spectral Properties; Polarization; Theory; Experiment

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1232
(DIAGNOSTICS AND INSTRUMENTATION)

(Data Transmission)
DEMONSTRATION OF FIBER OPTIC LINK APPLICATIONS IN UTILITY PLANT
MULTIPLEXED INSTRUMENT AND CONTROL SYSTEMS

W.D. Redus, G.R. Craig and W.J.B. Oldham

E-Systems, Inc., Greenville, TX 75401

FPII Report No. EPRI NP-1322 (01/1980).

Availability: EPRI

The application of data transmission via fiber optic cables has been demonstrated for a utility plant instrumentation system at the Bergen Generating Station operated by Public Service Electric and Gas Company (PSEG) of Newark, N.J. The fiber optic system (FOS) was designed, fabricated, and tested by E-Systems, Inc., Greenville Division, located in Greenville, Texas, using commercially available components. Plastic fiber optic cables were evaluated for short run applications up to 140 feet and glass fiber optic cables were evaluated for long run applications up to 1330 feet. The FOS and fiber optic cables were installed, operated, and maintained by PSEG's technicians under the management of PSEG with technical input from E-Systems, Inc. The demonstration was conducted over a ten month period.

Primary Keywords: Fiber Optics; Instrumentation; Control;

Electromagnetic Interference; Multiplex

COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1258
(ENERGY CONVERSION, THERMAL)
(Magneto-hydrodynamic)

HIGH POWER MAGNETOHYDRODYNAMIC SYSTEM (VOL II)
D.W. Swallow, D.K. Sonju, D.E. Meader and H. Becker
Maxwell Labs Inc., Woburn, MA 01881
AFAPL Report No. AFAPL-TR-78-51 (07/1978).

Availability: AD A664435
NTIS

The technical effort discussed in this report covers Phase B of the High Power Magnetohydrodynamic System program, which is a multi-phase program to develop liquid oxygen/liquid hydrocarbon magnetohydrodynamic generators using cesium seed for high performance, portable power supply applications. During this phase a lightweight, high performance hot gas flow train using liquid oxygen and JP-4 was designed and component modeling completed. The magnetohydrodynamic channel/diffuser performance parameters which were used as the design criteria were an output power of 30 MWe, a specific energy extraction of 1.0 MJ/kg, and a specific power density of 200 MWe/cu.m. To achieve these performance requirements, the required characteristic velocity efficiency of the combustion system was greater than 99%. During this program a limited amount of development testing was completed using a heat sink combustor and a diagnostics channel. These tests measured the combustor characteristic velocity efficiency and the gas electrical conductivity, as well as pressures, vibrations, and temperatures. The results of the development test program, which verified the design assumptions used to achieve the performance requirements, were a characteristic velocity efficiency of nearly 99% and a gas electrical conductivity at the magnetohydrodynamic channel inlet of 15 mhos/m.

53 Refs.

Primary Keywords: Portable Power Supplies; MHD Generators; Fast Start Power Supplies; Compact MHD Generator; Burst Power Supplies; High Performance MHD Generator; Flightweight MHD; Lightweight Megawatt Power Supplies; Cesium Seeding of MHD Gases; JP-4 Fueled MHD

1259
(ENERGY CONVERSION, THERMAL)
(Magneto-hydrodynamic)

HIGH POWER MAGNETOHYDRODYNAMIC SYSTEM (VOL I)
D.W. Swallow, D.K. Sonju, D.E. Meader and H. Becker
Maxwell Labs Inc., Woburn, MA 01881

AFAPL Report No. AFAPL-TR-78-51 (07/1978).

Availability: AD A664795
NTIS

The technical effort discussed in this report covers Phase B of the High Power Magnetohydrodynamic System program, which is a multi-phase program to develop liquid oxygen/liquid hydrocarbon magnetohydrodynamic generators using cesium seed for high performance, portable power supply applications. During this phase a lightweight, high performance hot gas flow train using liquid oxygen and JP-4 was designed and component modeling completed. The magnetohydrodynamic channel/diffuser performance parameters which were used as the design criteria were an output power of 30 MWe, a specific energy extraction of 1.0 MJ/kg, and a specific power density of 200 MWe/cu.m. To achieve these performance requirements, the required characteristic velocity efficiency of the combustion system was greater than 99%. During this program, a limited amount of development testing was completed using a heat sink combustor and a diagnostics channel. These tests measured the combustor characteristic velocity efficiency and the gas electrical conductivity, as well as pressures, vibrations, and temperatures. The results of the development test program, which verified the design assumptions used to achieve the performance requirements, were a characteristic velocity efficiency of nearly 99% and a gas electrical conductivity at the magnetohydrodynamic channel inlet of 15 mhos/m.

59 Refs.

Primary Keywords: Portable Power Supplies; MHD Generators; Fast Start Power Supplies; Compact MHD Generator; Burst Power Supplies; High Performance MHD Generator; Lightweight Megawatt Power Supplies; Cesium Seeding of MHD Gases; JP-4 Fueled MHD

1260
(SWITCHES, CLOSING)
(CLASS)

LIGHT-FIRED THYRISTOR DEVELOPMENT
E.S. Schlegel, E.C. Stryculla and L.R. Lowry
Westinghouse Electric Corp., Pittsburgh PA
EPRI Report No. EPRI EL-1916 (07/1981).

Availability: AD A664796
EPRI

A light-fired thyristor switch was demonstrated in one phase of a static volts-ampere-reactive generator and is presently under extended test at Minnesota Power and Light Company. The building of this 13.8-kV, bidirectional, 1200-A rms, solid-state switch required the development of the thyristor element and its special package, a light system consisting of laser diodes and a light distribution harness, and a special monitoring and protecting control circuit to protect the switch against various conditions under which it might not function safely. The switch is entirely self-contained and replaces the electrically gated version with no need for changes in the circuit to which it is connected. The report gives details on the development of each of the novel parts of the system, on the testing of each part of the system, and on the building, installation, and early evaluation of the switch. 0 Refs.

Primary Keywords: Thyristor; Optical Triggering; Bidirectional;

Performance Test

COPYRIGHT: 1978 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1261
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Liquid; Liquid; Electrical)

HIGH-VOLTAGE OIL GAP TESTS USING PARALLEL-PLANE ELECTRODES
T.K. Sloat, W.J. Carter and H.R. Moore
Westinghouse Electric Corp., Sharon, PA 16146
EPRI Report No. EPRI EL-1301 (12/1979).

Availability: EPRI EL-1301

A paraffinic-base insulating oil, PB, and a naphthenic-base insulating oil, NH, were evaluated using two electrode systems. The uniform field electrodes represented a method to easily test relatively large volumes of oil and showed the paraffinic-base oil, PB, had somewhat lower breakdown voltages on both 60-Hz tests and 1.2-X 50-microsecond impulse voltage tests. The rod to plane electrode system represented a more practical configuration that may occur in oil insulated apparatus and showed there was no substantial difference between the oils on the 60-Hz tests. The impulse tests on the rod to plane test showed the paraffinic-base oil had a higher dielectric strength than the naphthenic-base oil. The routine daily dielectric breakdown voltage tests using ASTM D1816 showed the paraffinic-base oil had a higher dielectric strength than the naphthenic-base oil. Since the uniform field tests made with larger volumes of oil indicated a possible weakness in the paraffinic-base insulating oil, it is not acceptable for use in electrical apparatus. 0 Refs.

Primary Keywords: Oil; Paraffinic; Transformers; Naphthenic; Breakdown Strength

Secondary Keywords: Circuit Breakers

COPYRIGHT: 1979 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1263
(ENERGY CONVERSION, ELECTRICAL)

(Power Supplies)
A 10 KW LIGHTWEIGHT DC CONVERTER (TECHNOLOGY FEASIBILITY STUDY FOR LIGHTWEIGHT MEGAWATT RANGE CONVERTERS)

F.C. Schwarz
Power Electronics Associates, Inc., Lincoln, MA 01773
AFAPL Report No. AFAPL-TP-77-45 (11/1977).

Availability: AD A649937
NTIS

The technology for an ultra-reliable, lightweight, high power DC converter is presented and supported by test data of a small 10 kW feasibility model. Reliability and a high efficiency near 97 percent are derived from a process of natural current commutation of fast switching thyristors in series resonant circuits. Lightweight is the result of an internal frequency near 10 kHz. The feasibility of 150 kW single modules with one set of thyristors is indicated. The salient features of this converter technology are highlighted. 17 Refs.

Primary Keywords: 10kW, 100kW, Submegawatt, Megawatt; High Voltage DC Supply; Natural Current Commutation; Series Resonant Circuit Power Converter; High Power Conditioner; Power Converters; Highly Reliable; Secondary Current Source

1264
(ENERGY CONVERSION, ELECTRICAL)

(Power Supplies)
DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE POWER SUPPLIES

J.P. Welsh
Thermal Technology Lab., Inc., Buffalo, NY
AFAPL Report No. AFAPL-TR-79-2049 (06/1979).

Availability: AD A076245
NTIS

Emphasis on this program was on the development of high voltage, high power, high frequency, low specific weight, inverter transformers. A primary intent was on the reduction of specific weight without sacrifice of electrical performance or reliability. Research was conducted in the choice of magnetic and dielectric materials, improved magnetic circuit modeling, and application of advanced heat transfer techniques. Computer-aided design methods were utilized and specialized programs were developed to permit extensive manipulation of multiple design parameters. One goal, to achieve a specific weight of 0.25 lb/kVA, was exceeded. A specific weight of about 0.10 lb/kVA was actually accomplished with a 200 kVA transformer. It is predicted that in larger transformer sizes, specific weights of 0.07 lb/kVA can be realized. The other goals of electrical performance and reliability were also achieved. The inverter transformers developed in this program exhibited unusually low leakage inductance and high efficiency. Higher reliability than conventional transformers should also be realized due to much lower operating temperatures (i.e.: lower thermal stress on conductors and insulation). The program has been successfully concluded and two basic transformer/rectifier unit designs (two each at 10 kW and 200 kW) were fabricated, demonstrated and delivered. 10 Refs.

Primary Keywords: Low Specific Weight Transformers; High Energy Density Transformers; Inverter Transformers; High Frequency Transformers

Secondary Keywords: Airborne Transformers; Lightweight Transformers

1265
(BREAKDOWN STUDIES)

(Gas; Optical)
A CW X-RAY PREIONIZER FOR HIGH-REPETITION-RATE GAS LASERS

T. Araki, H. Kubota and T. Fujikawa
Keio University, Kohoku-ku, Yokohama-shi, Japan
APPL PHYS LETT Vol. 36, No. 4 pp. 235-237 (02/1980).

Operation of a cw x-ray tube was used to introduce soft x-rays into a laser chamber. Arcing was seen to be suppressed by the cw x-ray preionizer. The advantages of the cw preionizer over a flash preionizer are discussed, along with the possible application of a cw preionizer to high repetition rate lasers. 10 Refs.

Primary Keywords: X-ray Preionization; Continuous Wave

Secondary Keywords: Krf Laser; High Rep-rate

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1266
(DIAGNOSTICS AND INSTRUMENTATION)

(Current)

ELECTRONIC CURRENT TRANSDUCER (ECT) FOR HIGH-VOLTAGE DC LINES
J.M. Houston, P.H. Peters Jr., H.R. Summerhaves Jr., G.J. Carlson and
A.M. Itan;
General Electric Co., Schenectady, NY 12301

EPRI Report No. EPRI EL-1343 (02/1980).

Availability: EPRI EL-1343

EPRI

This report deals with the development of a bipolar electronic current transducer (ECT) for measuring the current in a high-voltage DC (HVDC) power line at line potential. The design and construction of a freestanding ECT for use on a 400-kV line having a nominal line current of 2000 A (1 pu) is described. Line current is measured by a 0.0001 ohm shunt whose voltage output is sampled by a 12-bit digital data link. The high-voltage signal is transmitted over fiber optics to travel 300 m to a control room where the digital signal is converted back to an analog representation of the shunt voltage. The redundant electronic and optical data links are used in the prototype. Specification goals called for operation over the temperature range -40 to +50 Deg. C to an output accuracy of $\sim 0.6\%$ at 0.1 pu and $\sim 0.3\%$ between 0.3 pu and 1.0 pu. A frequency response greater than 370 Hz and a step response time of less than 2 ms was desired. Initial tests indicate that these goals have been met in the prototype structure. The unit is now installed and being evaluated at the Syliner converter station of the HVDC Pacific Intertie in California. 0 Refs.

Primary Keywords: HVDC; Electronic Transducer; Current Measurement; Fiber Optic Link

Secondary Keywords: Current Transducer

COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1267
(BREAKDOWN STUDIES: SWITCHES, OPENING)

(Gas; Recovery; Mechanical)

FUNDAMENTAL INVESTIGATION OF ARC INTERRUPTION IN GAS FLOWS
D.M. Benson (1), G. Frind (2), R.E. Kinsinger (2), H.T. Nagamatsu
(2), M.O. Moeske (2) and R.S. Sheer Jr. (2)
(1) State University of New York at Buffalo, Buffalo, NY 14226
(2) General Electric Co., Schenectady, NY 12301

EPRI Report No. EPRI EL-1455 (07/1980).

Availability: EPRI EL-1455

EPRI

The document reports on continuation of the study of thermal recovery in gas blast interrupters reported earlier in EPRI Report EL-284. The thermal recovery process was investigated with physical and aerodynamic methods. Typical and reduced nozzle sizes and short sinusoidal current pulses. Current-rise d/dt and gas pressures were measured on full-size interrupters. Aerodynamic characterization of the cold flow fields in several different nozzle types included measurements of the pressure and flow fields, both steady-state and turbulent components. With special attention given to wakes and shock structures. Special schlieren techniques on DC arcs and high-speed photography on arcs in orifice nozzles show that shock heating broadens the arc independent of turbulence effects and producing poorly recovering downstream arc section. Measured recovery speeds (RRRV) in both orifice and convergent-divergent nozzles agree with predictions of several arc theories assuming turbulent power losses. However, data on post-zero currents and power loss show values much smaller than theoretical predictions. Hydrogen, deuterium, and methane (CH_4) were measured to have thermal recovery speeds up to one hundred times that of SF_6 in the same conditions. Mixtures of $\text{Ar}/\text{Sub} 6/$ with $\text{CH}_4/\text{Sub} 4/$, $\text{C}_2/\text{Sub} 2/$, $\text{P}/\text{Sub} 6/$, $\text{He}/\text{Sub} 2/$ can give fast thermal recovery when used at high total pressure but moderate SF_6 content. 21 Refs.

Primary Keywords: SF_6 /Sub 6/; Thermal Recovery

Secondary Keywords: Circuit Breakers; Gas-Blast Interrupters

COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1269
(DIAGNOSTICS AND INSTRUMENTATION)

(Miscellaneous)

SF/SUB 6/ DIELECTRIC FILL GAS GAUGE
R. Bell, R. Hickstead, J. VanVleet and M. Berlin
Nucleonic Data Systems Inc., Irvine, CA 92714

EPRI Report No. EPRI EL-767 (04/1978).

Availability: EPRI EL-767

EPRI

The use of SF_6 /Sub 6/ gas-insulated equipment in substations is gaining wide acceptance. For reliable operation of this type of equipment, it is important that the gas density be maintained within design limits and that the gas not be contaminated. It is therefore of interest to have a gauge that can be used for continuous monitoring of the gas. Such a gauge should be able to detect leaks in excess of 1-2% per year as well as detect gas contaminants of significant levels. This project has shown that it is feasible to directly measure the density of the SF_6 /Sub 6/ gas, as well as measure the gas humidity. The prototype gauge, however, is rather complex and most likely would be more expensive than the conventional pressure gauges. The experimental gauge that has been developed uses the infrared absorption characteristics of the gases. A wavelength is chosen where the monitored gas absorbs strongly, but where interference from other gases is minimal. The photon absorption is approximately proportional to the density of the gas, which is also proportional to the dielectric strength of the gas. 24 Refs.

Primary Keywords: Photo-optic Pressure Gauge For SF_6 /Sub 6/ Gas; Infrared Light Absorption For SF_6 /Sub 6/ Gas; Infrared Light Absorption Of Water Vapor; Infrared Light Absorption Of SF_6 /Sub 6/ Gas Decomposition Products

COPYRIGHT: 1978 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1271
(BREAKDOWN STUDIES)

(Surface Flashover)

MECHANISM OF FAST SURFACE FLASHOVER IN VACUUM

R.A. Anderson
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 24, No. 2 pp. 54-56 (08/1973).
Insulator samples of Plexiglas and alumina ceramic in vacuum have been subjected to high-voltage pulses with rise times of a few nanoseconds. Breakdown paths were inclined to the electric field in the presence of a magnetic field normal to the insulator surface, analogous to the Hall effect for bulk conduction. These results, as well as measurements of the flashover propagation velocity, strongly support a model of the flashover mechanism based on secondary electron emission. 9 Refs.

Primary Keywords: Surface Flashovers; Vacuum; Plexiglass; Alumina Ceramic; Short Pulse Flashover; Secondary Electron Emission

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1272
(PARTICLE BEAMS; ION; PARTICLE BEAMS; ELECTRON; PARTICLE BEAMS; NEUTRAL; POWER TRANSMISSION; ENERGY STORAGE; CAPACITIVE)
(Reviews; Reviews; Reviews; Transmission Lines; Marx Generators)
PARTICLE BEAM FUSION PROGRESS REPORT OCTOBER 1977 THROUGH MARCH 1978
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND79-0002 (02/1979).

Availability: SAN79-0002

NTIS

Important data showing the transport of electrical power in the terawatt range over 6.5 meters with a power transport efficiency of 100 percent and an energy transport efficiency of 90 percent were obtained. These results were required for EBFA and demonstrated the feasibility of the vacuum interface, magnetically insulated line, and diode concept. The results exceeded expectations and provided a 2 ns rise from zero to peak of a 0.4 MA current. Magnetically insulated power flow densities exceeding 1011 W/sq.cm. were achieved over shorter distances. These results indicate that a much smaller beam drift distance to the pellet could be possible. Although about 50 percent of the total electron current flows external to the conductor boundary during the 6.5 meter transport, all of the current was recuperated and most was focused to a few nm spot during these experiments. 23 Refs.

Primary Keywords: Pulse Forming Lines; Marx Generator

Secondary Keywords: Trigger Switch; Intermediate Storage Capacitor; Gas Pressure Transducer

1273
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
APPLICATION OF GENERATOR ANALYSIS METHODS

R. Kuhier
University of Kentucky, Lexington, KY 40506

AFAPL Report No. AFAPL-TR-77-31 (04/1977).

Availability: AD-A042071

NTIS

This study provides a theoretical model for simulating a wide variety of transient loading conditions for alternators. The model is represented as an equivalent circuit in a format compatible with the SCEPTRE computer program. SCEPTRE solves the resulting circuit equations for the transient response. Also addressed in this study is the inclusion of an effective saturation property into the SCEPTRE formulation resulting in a more realistic and accurate nonlinear machine model. 2 Refs.

Primary Keywords: SCEPTRE Simulation; Alternator Modeling; Saturation Effects; Linear Machine Model

1274
(ENERGY CONVERSION, ELECTRICAL)

(Power Supplies)

DEVELOPMENT OF LIGHTWEIGHT TRANSFORMERS FOR AIRBORNE HIGH POWER SUPPLIES
D.L. Lockwood, R.I. McNeil Jr. and R.L. Haemmerle
Thermal Technology Lab, Inc., Buffalo, NY

AFAPL Report No. AFAPL-TR-76-102 (12/1976).

Availability: AD-A041515

NTIS

Several major developments have occurred in this program. As is often the case in research, they did not occur exactly in accordance with the original plan. The total program however is essentially on schedule. New techniques for fabrication of piwound transformers were developed which yielded superior designs. This development was followed by the development of computer aided design programs for piwound transformer. Some 10 kW transformers have been fabricated and subjected to a variety of tests. Based on the results of these tests both the 10 kW and 200 kW transformers will be piw rather than layer wound. A 10 kW transformer rectifier system is presently being integrated with a breadboard inverter for final verification. During the first half of this program, a numerical method was developed for the solution of the nonlinear lumped parameter transformer model. This model was developed under the previous contract, but no stable solution had been found. The present solution is for a resistive load and work is continuing to include leakage inductance, shunt capacitance, and an arbitrary load impedance. The materials studies support of the 200 kW transformer task are completed with exception of evaluation of some of the newer fluorine based dielectric fluids. Preliminary designs indicate specific rights in the neighborhood of 0.05 lb/kVA for these transformers. 9 Refs.

Primary Keywords: Low Specific Weight Transformers; High Voltage, High Power Transformers; High Energy Density Transformers

Secondary Keywords: Airborne Transformers; Lightweight Transformers

1275
(ENERGY STORAGE, INDUCTIVE)

(Inductors)

INDUCTOR NETWORK DEVELOPMENT FOR AIRCRAFT HIGH POWER SUPPLIES
J. Tang, R.L. Bryan, S. Ghoshroy, L.M. Lontai and O.K. Sonju
Maxwell Labs, Inc., Woburn, MA 01801

AFAPL Report No. AFAPL-TR-77-15 (04/1977).

Availability: AD-A052750

NTIS

This report presents the results of a study program undertaken to perform a comparative analysis of several approaches to the generation of high electrical power by storing tens to hundreds of kilojoules of energy in a compact, superconducting inductive system with efficient extraction in short bursts at high repetition rates. The critical factors for the comparison were the weight, volume, dissipation and reliability of the system and components for various operating regimes characterized by pulse power, repetition rate and pulse shape. Research and development work in this area undertaken in the U.S. and abroad has demonstrated the feasibility of operating inductive storage systems storing ten to perhaps one hundred kilojoules of energy with extraction rates of tens of pulses per second at pulse durations of the order of a few hundred microseconds with state-of-the-art technology. The major effort of this study was directed towards developing analytical tools to predict the performance of superconducting coils at repetition rates of 100-1000 pps with pulse discharge times of 20-40 microseconds and to evaluate the relative merits of different circuit configurations for storage and extraction of energy at high average power (3-10 MW). 0 Refs.

Primary Keywords: Inductive Energy Storage; Superconductivity; Pulsed Power

Secondary Keywords: Power Conditioning

L9

- 1227**
 (REVIEWS AND CONFERENCES; POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, OPENING; POWER TRANSMISSION; ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, CAPACITIVE; ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)
 (Reviews; Reviews; Reviews; Reviews; Reviews; Reviews; Reviews; Reviews; Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 1: INTRODUCTION TO POWER CONDITIONING SYSTEMS
 W.J. Sergeant
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-515 (10/1980).
 Availability: LA-UR-80-515
 LASL
 This lecture provides a definition and tutorial overview of power conditioning systems. Many specific examples of energy storage switches are discussed, along with pulse forming techniques. Definitions are given for several pulse parameters with justification for each included. Problems with pulse forming, timing cross-talk, and switch recovery are discussed. Several types of switches are discussed, including ignitrons, thyristors, and spark gaps, as well as hard tube switches and power conditioning systems. Pulse transformers are also briefly discussed. This lecture is designed as an introduction to the series, with most topics discussed in greater detail in other lectures. 3 Refs.
Primary Keywords: Ignitron; Thyatron; Spark Gap; Pulse Forming Network; Rep-Rated; Hard Tube; Pulse Transformer
Secondary Keywords: Charging Circuit; Overshoot; Peak Power; Loads
- 1278**
 (ENERGY CONVERSION, ELECTRICAL; PULSE GENERATORS; INSULATION, MATERIAL)
 (Power Supplies; Hard-tube; Reviews)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 2: DC POWER SUPPLIES AND HARD-TUBE POWER CONDITIONING SYSTEMS
 W.J. Sergeant
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-515 (10/1980).
 Availability: LA-UR-80-515
 LASL
 This lecture discusses the major characteristics of DC power supplies and hard-tube pulsers. Full-wave bridge rectifier circuits are discussed in detail, with a complete analysis of operation presented. Design criteria pertaining to high voltage diode stacks are presented with a summary of pitfalls inherent to the stacks included. Insulation for these high voltage supplies is discussed. A detailed conceptual discussion of hard-tube pulsers is also presented with a brief mathematical analysis included. 8 Refs.
Primary Keywords: Power Supply; Hard-tube Pulsar; Rectifier Circuit; Diode Stack
Secondary Keywords: Insulation; Transformer; Filter; Multi-phase
- 1279**
 (ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS; PULSE GENERATORS; PULSE GENERATORS)
 (Pulse Generators; Marx; Blumlein Lines; Field Reversal)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 3: PULSE VOLTAGE CIRCUITS
 W.L. Willis
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-2082 (10/1980).
 Availability: LA-UR-80-2082
 LASL
 The author presents a detailed conceptual discussion of Marx generators, blumleins, and spiral generators with a detailed quantitative discussion of Marx generators included. Several types of Marx generator are discussed, including the Erwin and Martin type generators. Inversion generators, wrapped line generators, and coaxial generators are discussed as sub-topics. Many practical applications are discussed. 1 Refs.
Primary Keywords: Marx Generator; Blumlein; Folded Co-ax Blumlein; Spiral Generator; Design Considerations; Erwin Marx; Martin Marx
Secondary Keywords: Inversion Generator; Wrapped Line Generator; Coaxial Generator; Charging Methods
- 1280**
 (POWER CONDITIONING; ENERGY STORAGE, CAPACITIVE)
 (Pulse Forming Networks; Capacitors)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 4: TRANSMISSION LINES AND CAPACITORS
 R.R. Butcher
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-79-1044 (10/1980).
 Availability: LA-UR-79-1044
 LASL
 Lecture 4 begins with a detailed analysis of transmission lines used as pulse forming networks (PFN's) and proceeds to analyze and discuss lumped PFN's. Extensive quantitative analysis is presented with practical considerations included. Types A, B, C, D, E, and F Guillen networks are discussed with a quantitative analysis of type C networks presented in depth. Capacitors are mentioned briefly with emphasis on parasitic inductance and its effect. An appendix by H.J. Sergeant is included which presents a qualitative and quantitative analysis of energy storage capacitors. Basic capacitor parameters are discussed, leading into a discussion of parasitic inductance, environmental considerations, and lifetime. Construction materials are discussed in some detail. 17 Refs.
Primary Keywords: Transmission Lines; Guillen Network; Mathematical Analysis; Capacitor
Secondary Keywords: Practical Considerations; Corona; Leakage Inductance; Leakage Capacitance
- 1281**
 (SWITCHES, CLOSING; POWER CONDITIONING)
 (Applications; Pulse Forming Networks)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 5: DISCHARGE CIRCUITS AND LOADS
 W.J. Sergeant
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-2771 (10/1980).
 Availability: LA-UR-80-2771
 LASL
 This lecture discusses, qualitatively and quantitatively, the design and operation of pulse forming networks. Choice of switches to use is discussed, along with the choice of capacitors and other components. A detailed discussion of practical problems, such as load faults, voltage reversal at the end of the discharge, and varying load impedance, is presented. The main characteristics of spark gaps, ignitrons, thyristors, and thyristors are described and related to application in PFN's. A brief analysis is presented for pulse transformers with design criteria included. Several types of laser loads are described and characterized. Several specific applications are presented. 11 Refs.
Primary Keywords: Pulse Forming Network; Spark Gap; Thyatron; Ignitron; Thyristor; Pulse Transformer; Design Optimal; Electrical Pulse Operations
Secondary Keywords: Voltage Inversion; Free-Running Load; Laser Pumping
- 1282**
 (SWITCHES, CLOSING; SWITCHES, CLOSING)
 (Gas Gaps; Reviews; Gas Gaps; Materials)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 6: SPARK GAPS
 W.L. Willis
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-634 (10/1980).
 Availability: LA-UR-80-634
 LASL
 This lecture deals in some detail with breakdown mechanisms to spark gap performance. Self-break gaps, electronically triggered gaps, and optically triggered gaps are discussed in some detail, with e-beam triggered gaps mentioned. Formulas abound for determination of spark gap performance as function of materials and operating parameters. A field enhancement factor is defined and used to calculate the breakdown voltage of several gap configurations, and the breakdown voltage is related to the Paschen curve. The merits of various triggering methods are discussed. Liquid and solid dielectric gaps are discussed qualitatively with some quantitative analysis included. 7 Refs.
Primary Keywords: Spark Gap; Gas Breakdown; Self-break; Triggering; Recovery; Erosion; Paschen Curve
Secondary Keywords: Liquid Dielectric; Solid Dielectric
- 1283**
 (SWITCHES, CLOSING; SWITCHES, CLOSING)
 (Thyatrons; Ignitrons)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 7: THYATRONS AND IGNITRONS
 W.J. Sergeant
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-517 (10/1981).
 Availability: LA-UR-80-517
 LASL
 Lecture 7 begins with a conceptual description of thyatrons and ignitrons and proceeds to describe construction and operation of thyatrons and ignitrons in detail. Triggering, charging techniques, and biasing of thyatrons and ignitrons are considered; as are applications and limitations of both devices. Several practical circuits are presented and discussed. The types of thyatrons and ignitrons available are presented and the merits of each are discussed. The state of the art in current thyatron technology is presented, as well as the devices under development for the near future. A compendium of information assembled from manufacturers' data sheets and literature on the theory and application of thyatrons is included as an appendix. 34 Refs.
Primary Keywords: Thyatron; Ignitron; Theory; Application; State-of-the-art; Devices Under Development; Trigger Circuit; Recovery Time
Secondary Keywords: Charging Circuit; Delay; Recovery Mechanism
- 1284**
 (ENERGY CONVERSION, ELECTRICAL)
 (Power Supplies)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 8: CHARGING CIRCUITS
 W.C. Munnely
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-UR-80-2044 (10/1980).
 Availability: LA-UR-80-2044
 LASL
 Lecture 8 of the series complements Lecture 1 by discussing the AC portion of power supplies. Advantages and disadvantages of multi-phase circuits are discussed with design criteria presented. Voltage ramp, monocyclic constant current, constant power, and saturable reactor charging systems are presented and analyzed, as well as standard charging power supplies. Criteria are presented on choosing a diode stack and the pitfalls of choosing incorrectly. Several snubber circuits are presented and analyzed in detail. Resonant charging systems are discussed in brief.
Primary Keywords: Power Supply; Voltage Ramp Power Supply; Monocyclic Constant Current Power Supply; Constant Power Power Supply; Saturable Reactor Power Supply; Resonant Charging Power Supply; Choice Of Components; Snubber
Secondary Keywords: Diode Stack
- 1285**
 (POWER CONDITIONING)
 (Pulse Transformers)
LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY; LECTURE 9: PULSE TRANSFORMERS AND DIELECTRICS
 G.J. Rohrbach
 Sandia Labs, Albuquerque, NM 87115
 Sandia Report No. SAND80-0451 (10/1980).
 Availability: SAND80-0451
 SANDIA
 Lecture 9 is a comprehensive review and tutorial on air core pulse transformer design. Helical wound and spiral strip transformers are discussed with design criteria presented. Insulation requirements and voltage grading techniques are analyzed with electrostatic shielding included. The effect of shielding on transformer efficiency and methods of minimizing these effects are analyzed. Dielectric properties and several breakdown models for n-Hexane, Mylar, and various oils are presented and discussed. Results of partial discharges are demonstrated. Voltage stress profiles in two-dielectric insulator configurations are discussed briefly. 32 Refs.
Primary Keywords: Air Core Transformer; Helical Wire Transformer; Spiral Strip Transformer; FRIZZ; Helical Transformer; Equivalent Circuit; Eddy Current; Electrostatic Shield; Breakdown Model
Secondary Keywords: Pulse Breakdown; Mylar Film; Breakdown Strength; Conductive Liquid Shield

1286
(DIAGNOSTICS AND INSTRUMENTATION)
(Reviews)

LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY: LECTURE 10:
MEASUREMENT TECHNIQUES

W.L. Willis
Los Alamos National Labs, Los Alamos, NM 87545
LAST Report No. LA-UR-80-2272 (10/1980)
Availability: LA-UR-80-2272
LASL

In Lecture 10, various voltage and current diagnostic techniques are discussed. Spark gaps, capacitive dividers, resistive dividers, and combinations of capacitive and resistive dividers are discussed as voltage diagnostics for high voltage circuits. Electrostatic voltmeters are presented for slowly varying and DC circuits. Kerr cells are discussed as an alternative for very fast measurements. Current measurements are discussed in the form of current viewing resistors, Rogowski loops, current transformers, Hall effect probes, and Townsend rotation probes. Several good references are included. 5 Refs.

Primary Keywords: Voltage Measurement; Current Measurement; Spark Gap; Electrostatic Voltmeter; Capacitive Divider; Resistive Divider; Mixed Divider; Current Viewing Resistor; Rogowski Loop; Current Transformer; Hall Effect Probe

Secondary Keywords: Electro-Optic Effect; Townsend Rotation

1287
(DIAGNOSTICS AND INSTRUMENTATION)

LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY: LECTURE 11:
PARTICULAR APPLICATIONS

R.P. Butcher
Los Alamos National Labs, Los Alamos, NM 87545
LAST Report No. LA-UR-80-3506 (12/1980)
Availability: LA-UR-80-3506
LASL

Lecture 11 applies some of the techniques presented in Lecture 10 to determine voltage and current waveforms for a laser load driven by a transmission line pulse forming network (PFN). Lecture 11 then expands upon these measured quantities to derive values for the total electrical power delivered to the load, real power dissipated in the load, total energy delivered to the load, and time varying load impedance. The values are compared to computer simulation of the circuit and agreement is seen to be good. 7 Refs.

Primary Keywords: Discharge Circuit; Circuit Operation; Voltage Measurement; Current Measurement; Peak Power; Varying Load Impedance

Secondary Keywords: Laser Load

1288
(REVIEWS AND CONFERENCES; ENERGY STORAGE; POWER TRANSMISSION)
(Reviews; Systems; Systems)

LECTURES ON HIGH-VOLTAGE AND PULSE POWER TECHNOLOGY, LECTURE 13:
GROUNDING AND SHIELDING TECHNIQUES

T.P. Burke
Texas Tech University, Lubbock, TX 79409
LAST Report No. LA-UR-80-3330 (10/1980)
Availability: LA-UR-80-3330
LASL

Lecture 13 pertains to grounding and shielding techniques for pulse power applications. The author discusses grounding techniques for personnel safety, power flow, and instrumentation. The merits of series grounding, parallel grounding, and single-point grounding are discussed. Advantages of ground planes are presented, along with some of the pitfalls of utilizing ground planes properly. Electrostatic shielding of instrumentation cables is presented with a discussion of stray capacitance coupling included. Magnetic shielding is discussed briefly. 5 Refs.

Primary Keywords: Electrostatic Shield; Magnetic Shield; Grounding Techniques; Safety Ground; Power Ground; Instrumentation Ground

Secondary Keywords: Ground Loop; Humidity Effects; Voltage Gradient; Low Frequency Noise

1289
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas; Electrical; Gas)

INVESTIGATION OF HIGH-VOLTAGE PARTICLE-INITIATED BREAKDOWN IN GAS-INSULATED SYSTEMS

R.E. Wootton
Westinghouse Electric Corp., Pittsburgh PA
EPRI Report No. EL-1007 (03/1977)
Availability: EPRI EL-1007
EPRI

This report describes an experimental and theoretical study of the processes involved in electrical breakdown in compressed gases, where the breakdown is initiated by conducting particles. The report contains a great deal of detailed quantitative data relating to particle-initiated breakdown in large coaxial and uniform electrode systems at voltages of several hundred kV. One finding of interest is the variation of the critical radius of breakdown with particle-to-electrode spacing at the instant of breakdown in SF₆/sub 6% Ar gas pressures typically used in electrical power transmission equipment. The variation of this critical spacing with SF₆/sub 6% Ar gas pressure has been determined and the results are reported. The statistical nature of particle-initiated breakdown has also been studied and the effects of the presence of multiple particles and/or the duration of application voltage reported. Further results given include data for different gases and gas mixtures, particle sizes and materials, corona and wind effects, particle deformation, AC and impulse voltages and other factors. 12 Refs.

Primary Keywords: Gas-Insulated Systems; Gas Insulation; Particle Transport; Particle-Initiated Breakdown; SF₆/sub 6% Ar

Secondary Keywords: Under-50 GJ Transients
Copyright: 1979 ELECTRIC POWER RESEARCH INSTITUTE, INC. REPRINTED WITH PERMISSION

1290
(POWER TRANSMISSION)
(Transmission Lines)
ELECTROSTATIC AND ELECTROMAGNETIC EFFECTS OF ULTRAHIGH-VOLTAGE TRANSMISSION LINES

L.D. Zaffanella and D.W. Deno
General Electric Co., Pittsfield, MA 01291
EPRI Report No. EPRI EL-802 (06/1978)
Availability: EPRI EL-802
EPRI

This report presents the results of research on electric and magnetic field effects of high voltage AC power lines performed at EPRI's Project UHV from January 1974 to December 1977. Only 'electrical' rather than 'biological' research was performed. This research is applicable to UHV as well as to EHV transmission lines. Calculation methods and measuring techniques have been developed for transmission line fields and their effects. Steady state and spark discharge currents induced in persons and objects have been investigated with laboratory and full scale tests using a three-phase UHV line. Different methods to reduce the electric field of UHV lines have been investigated, such as grids of grounded wires and lower voltage circuits built underneath the UHV lines. Unusual effects of high electric fields, such as people's reaction to various types of exposures, wood pole burning, and corona on grounded objects, were experienced during the operation of the UHV three-phase test line. These effects have been investigated and design data have been provided. 3 Refs.

Primary Keywords: Electrostatics; Electromagnetics; Electric Field; Transmission Line; Corona

Secondary Keywords: Induction
Copyright: 1978 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1291
(INSULATION, MATERIAL)

LIQUID

CHARACTERISTICS OF INSULATING OIL FOR ELECTRICAL APPLICATION

T.K. Sloat
Westinghouse Electric Corp., Sharon, PA 16146
EPRI Report No. EPRI EL-1300 (12/1979)

Availability: EPRI EL-1300
EPRI

It has been established that the supply of naphthenic type of petroleum crudes historically used for the manufacture of electrical insulating oils is diminishing, and the oil companies have recommended that the more readily available paraffinic types of crudes should be substituted to produce the insulating oil required by the electrical industry. The purpose of this project was to determine if an insulating oil manufactured from paraffinic-type crudes was interchangeable with the presently accepted insulating oil and would perform the same function without major changes in designs or in operating conditions. Paraffinic crude oils are known to contain waxes which are wax that is not removed, could provide an insulating oil having a high pour point which could interfere with the low-temperature functioning of most electrical equipment. Because of the wax problem, it was necessary to study the behavior of the paraffinic-base insulating oil in representative production-size equipment to ensure low temperature operability. Other studies, such as material compatibility, lubricity of the new oil, arc-formed gas, response to dielectric breakdown levels, represented in large power transformers, and accelerated aging in distribution transformers, were important to ensure full acceptance of a replacement oil. This evaluation of experimental oils indicated that paraffinic transformer oils as a class can provide useful supplements or replacements for naphthenic oils. 2 Refs.

Primary Keywords: Oil; Paraffinic; Naphthenic

Secondary Keywords: Transformer; Circuit Breakers

Copyright: 1979 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1292
(PARTICLE BEAMS; ION; PARTICLE BEAMS; ION; PARTICLE BEAMS; ION)

GENERATION, TRANSPORT, TARGET INTERACTIONS
BLIP REQUIREMENTS FOR LIGHT-ION DRIVEN INERTIAL-CONFINEMENT FUSION

D. Moyer (1); D.G. Colmbo (1) and S.A. Goldstein (2)

(1) Naval Research Lab., Washington, DC 20375

(2) LASLOR Inc., Alexandria, VA 22304

EPRI Memorandum Report No. 6397 (11/1980)

Availability: AD A092422
NTIS

Pulsed-power and ion-beam production and handling techniques are available to assemble a break-even ICF experiment. In this report, system design is laid out for beam focusing, transport, bunching and packing are combined to define an acceptable range of parameters for an ion source module delivering ion-atomic-number ($Z=6$) ion beams to a pellet. Techniques for increasing the deliverable beam intensity are then discussed. 18 Refs.

Primary Keywords: Light Ion Beams; Ion Focusing; Ion Transport; Beam

Packing; Beam Punching; Pinch Reflex Diode

Secondary Keywords: Inertial-Confinement-Fusion Module; System Requirements

1293

(POWER CONDITIONING)

(Pulse Forming Lines)

DESIGN STUDY FOR AN AURORA MODIFICATION LEADING TO A 100-TERAWATT

NUCLEAR WEAPON RADIATION

A.G. Stewart and G.A. Muttin
Harry Diamond Labs, Adelphi, MD 20783

Report No. HD-IM 79-3 (02/1979)

Availability: AD A071339
NTIS

The AURORA machine can be converted to provide beam power outputs near the 10T14 W power level into low impedance loads. The proposed conversion is based on a novel approach to pulse power intensification. The approach can be adapted to AURORA in differing configurations. A device of toroidal geometry utilizes the fast pulse charge capability of the AURORA generator to inject a traveling electromagnetic wave into a toroidal oil filled coaxial line. From the point of injection, electromagnetic waves are propagated along the axis of the torus in opposite directions and at some time will meet at another point on the torus diametrically opposite the injection point. As the electromagnetic waves obtain their portion of their energy storage in the magnetic field, they will be transformed into electrostatic energy, and the voltage in this region will double. At some optimum pre-selected time t_1 , where $t_1 > t$, the toroidal line is then switched circumferentially into an oil-insulated three-electrode parallel plate transmission line to the diode load. A transmission-line model for the complete system has been developed and analyzed by computer to determine energy transfer efficiencies and power inputs into a matched ohmic load. It has been determined that peak power levels of 90 TW are achievable in a pulse of 30 ns full width at half maximum.

Primary Keywords: High Pulsed Power; High-Intensity Electron Beams; Accelerator Technology

1302
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

SUPERCONDUCTING ROTOR RESEARCH

B.B. Gamble, T.A. Kain and P.K. Price
General Electric Co., Schenectady, NY 12301
AFPL Report No. AFPL-TR-77-68 (11/1977).

Availability: AD-A53612
NTIS

This report summarizes work completed for the Air Force Aero Propulsion Laboratory in Phase I of a program entitled "Superconducting Rotor Research." The objective of this program is to incorporate new materials in the design of an airborne, 20 MW, high-speed, superconducting generator. The rotor of the generator will be constructed and its current density demonstrated. The Phase I work consisted of a sizing study to select the machine configuration and dimensions, a survey of superconducting materials, and selection of the superconductor for this application. 13 Refs.

Primary Keywords: Oxygen; Superconductivity; Synchronous generators

1303
(SWITCHES, CLOSING)
(Thyristors)

LIGHT-TRIGGERED THYRISTORS FOR ELECTRIC POWER SYSTEMS

V.A.K. Temple and J.P. Ferraro
General Electric Co., Schenectady, NY 12301
EPR Report No. EPR-1349 (03/1980).

Availability: EPR; ERIC

A program was devised to develop a method of triggering a 5-mm, 2600-volt, 1,000-amp thyristor with a light source as described. Normally, these devices are electrically triggered, but the need for placing a large number of them in series in the primary line insulation made electrical triggering difficult. In this problem, a light source was getting focused on the device, which was triggered by two layers of it. A secondary light source was used to trigger the thyristor. Results were a turn-on capability to handle a voltage waveform range of 2000 volts per microsecond. Both a 2000-volt input to the thyristor and a 10 microsecond rise time was accomplished and investigated in high rates of current flow at the instant of light trigger. This resulted in excess temperature levels in insulated areas where the current flow was initiated. Packaging and light source options are discussed. 13 Refs.

Primary Keywords: Thyristors; Power Electronics; Optical Triggering System

COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE INC

1304
(SWITCHES, CLOSING)
(Thyristors)

LIGHT-TRIGGERED THYRISTORS FOR ELECTRIC POWER SYSTEMS (PHASE 2)

V.A.K. Temple and B. Jackson
General Electric Co., Schenectady, NY 12301
EPR Report No. EPR-1349 (03/1980).

Availability: EPR; ERIC

This report marks a milestone in the development of thyristors suitable for HVDC applications. Three devices were constructed with 5, 6, and 2 amplifying stages, respectively, with several sub-variations. Of these, the 4 amplifying stage GE3 type D device and all variations (A, B, & C) of the two stage GE4 design proved sufficiently reliable for one or one replacement of the normal, electrically triggered 2.6 kV HVDC cell. Important device characteristics other than a typical 160 V_{BR} chosen as better di/dt at 105 sec C and 1800 volts were: (1) type 61 forward breakdown voltage of 2900 volts, (2) typical reverse breakdown voltage of 3100 volts, (3) di/dt capability of 2000 V/microsec to 2200 volts; (4) forward di/dt of 125 deg C, 1000 amperes of 1.3 volts and, finally, (5) a typical turn-off threshold of 10 to 20 nanoseconds of incident photo energy. Surge capability and other device ratings are similar to the conventional electrically triggered device. It is also significant that both the fabrication and packaging of these devices took place in a production facility and that the light triggered thyristor could be fabricated with the same process, apart from the extra sensitivity of the light triggered device.

Primary Keywords: Thyristors; Power Electronics; Optic Triggering

COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1305
(BREAKDOWN STUDIES)
(Prev. Edns.)

THE PREVENTION OF ELECTRICAL BREAKDOWN IN SPACECRAFT

F.W. Paul and P. Burroughs
Goddard Space Flight Center, Greenbelt, MD
NASA Preprint No. NASA CR-1748 (01/1977)

Availability: AD-A53644
NTIS

This paper on high voltage electrical breakdown provides a basic understanding of the phenomena and problems encountered in the use, design, and fabrication of high voltage systems for spacecraft. The material was compiled from the literature listed in the bibliography and from conference with experienced personnel at Goddard Space Flight Center, Jet Propulsion Laboratory, Pasadena, California, and the University of Colorado. 19 Refs.

Primary Keywords: Electrical Breakdown; Design Considerations

1306
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Gas, Electrical)

PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM

C.M. Coke
Massachusetts Institute of Technology, Cambridge, MA
EPR Report No. EPR-EL-1264 (11/1979).

Availability: EPR; ER-1264
ERIC

The adverse influence of conducting particle contaminants in gas-insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and DC voltages to 1500 kV. Particle dynamics was shown to be important and related to breakdown initiation in the gas. Both SF₆/sub 67/ and N₂/sub 27/ gases at pressures of 4 or 14.6 atm abs. were used. The particles were randomly introduced and ranged from 1 to 100 microns and 100 microns. Effects in the gas gap as well as along surfaces of solid insulators were studied. Visual observations, photography, and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor. By coordination of this work with a separate study at the Westinghouse R&D laboratory, a comparison between DC and AC performance was made. Generally the DC breakdown values exhibited higher scatter, though their limit was similar to that found under AC. Overall fundamental forces and processes which involve particle motion which effects were identified and found to be the same for DC to AC voltage stresses. 30 Refs.

Primary Keywords: Gas Insulation; Particle-initiated breakdown; SF₆/sub 67/; N₂/sub 27/; Dielectrics

Secondary Keywords: Gas-insulated Cable; Underground Transmission Cables; 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1307
(INSULATION, MATERIAL; INSULATION, MATERIAL)
(Gas, Liquid)

SF₆/sub 67/ OIL DIELECTRIC FOR POWER TRANSFORMERS

E.J. Welsh, J.A. Robinson and R.C. Wendel
Westinghouse Electric Corp., Sharon, PA 16146
EPR Report No. EPR-EL-1358 (03/1980).

Availability: EPR; EL-1358

This project was designed to evaluate the potential for providing a superior gas/oil insulating and cooling system for liquid filled transformers. The potential benefits of using the electronegative SF₆/sub 67/ oil have included: (1) SF₆/sub 67/ has a higher dielectric strength than SF₆/oil; (2) SF₆/sub 67/ is more stable than SF₆/oil; (3) SF₆/sub 67/ is more compatible with transformer materials; (4) SF₆/sub 67/ has a lower viscosity than SF₆/oil; (5) SF₆/sub 67/ is less expensive than SF₆/oil. A test program involving electrical, chemical, and physical properties indicated that the SF₆/sub 67/oil combination appeared satisfactory as an insulating medium. No short term reduction in insulating or cooling capacity was determined in SF₆/sub 67/oil filled transformers. However, some of the results obtained in the longer term transformer testing using SF₆/sub 67/oil and oil indicated that prolonged exposure of currently designed transformers to SF₆/sub 67/ is to be avoided. It was determined that due to the high degree of solubility of SF₆/sub 67/ in transformer oil, degassing under thermal or electrical stress could result in extensive bubble formation. It was determined, however, that under our test conditions, SF₆/sub 67/oil bubbles did not reduce the insulating capacity of the liquid medium as did nitrogen gas bubbles under the same test conditions. As a result of this study, many previously unknown areas concerning electronegative gas/oil systems have been clarified and the results from these studies have given rise to some new concerns for allowing SF₆/sub 67/ to enter existing oil-filled transformers. 13 Refs.

Primary Keywords: Sulfur Hexafluoride; Transformers; Oils; Dielectric Strength; Hexafluoroethane

Secondary Keywords: Solubility
COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1308
(BREAKDOWN STUDIES)

(Gas, Electrical)

STUDY OF LIGHTNING CURRENT MAGNITUDE THROUGH DISTRIBUTION ARRESTERS

G.L. Armstrong, M.S. Koskiyan and K. Johnson
The Detroit Edison Co., Detroit, MI 48226

EPR Report No. EPR-EL-1242 (09/1979).

Availability: EPR; EL-1242
ERIC

This project was undertaken by the Detroit Edison Company on behalf of the Electric Power Research Institute to: 1. Determine the current magnitude of lightning surges discharged through distribution arresters. 2. Determine the frequency of lightning strokes through distribution arresters. In the fulfillment of these objectives, the currents were determined from arrester gap etchings caused by lightning surges. Inspection of the gaps led to the conclusion that two distinct types of etchings had been produced. These were compared to E-120 microsecond surges and to surges of longer duration produced by tests at the General Electric Laboratory. 5 Refs.

Primary Keywords: Surge Arresters; Lightning Currents; Distribution Surge Protection; Distribution Arresters; Lightning Strike Characteristics

COPYRIGHT: 1979 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

1309
(REVIEWS AND CONFERENCES; ELECTROMAGNETIC COMPATIBILITY)
(Review: Grounding And Shielding)
EMI INTERACTION: PRINCIPLES, TECHNIQUES, AND REFERENCE DATA (A COMPREHENSIVE CONCERNATION OF TECHNOLOGY FROM THE EMI INTERACTION NOTES) EMI INTERACTION 2-1
K. S. H. Lee (Ed.)
Dikewood Industries, Inc., Albuquerque, NM 87106
AFRL Report No. TR-80-402 (12/1980)
Availability: AD A100528 NTIS

This work is divided into three parts. The first part, Principles and Techniques, concerns general concepts and calculational procedures from electromagnetic theory relevant to EMI interaction. This contains a discussion on the concept of electromagnetic topology which is used to divide complex systems into somewhat smaller orbits in an ordered way. This concept is fundamental to the organization and understanding of this work and is expected to lead to further insights and computational techniques. Of course, there are many other concepts and techniques which play important roles and which are discussed in this part. The second part, Formulas and Data, considers the information concerning the pieces of the system. The organization of this part is based on the system topology, specifically the hierarchical topology which divides the system into layers. Each layer is further broken into three ordered parts: coupling, propagation, and separation. Having considered, first, the general concepts and techniques for EMI interaction and, second, the specific information concerning the pieces, we come to the third part, System Applications. This part attempts to illustrate the use of the previous parts in analyzing the EMI interaction with complex systems. Hypothetical system examples are chosen to illustrate the concepts and decomposition of the problem for selected signal paths.

Primary Keywords: Application; Coupling; EMI; Interaction
Secondary Keywords: Aerospace System; Aircraft; Ground Based Systems

1312
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PHOTOGRAPHIC OBSERVATIONS OF IMPULSE BREAKDOWN IN SHORT VACUUM GAPS
J. D. Chalmers and P. D. Prutton
University of Strathclyde, Glasgow, Scotland
Journal: J. Physics D: Applied Physics Vol. 12, No. 8, pp 1285-1292 (1979)

An impulse intensifier and image converter with a maximum sweep speed of 1 ns/mm have been used to observe the development of impulse breakdown in short vacuum gaps of up to 1 mm. Electrodes of stainless steel, copper and aluminum have been used and it has been found that in each case, metal vapor is always produced first at the cathode surface and later at the anode surface. The final arc discharge develops by propagation of the anode vapor. Time delays between voltage application and the appearance of the anode vapor have been measured in the range 10-50 ns and their dependence upon electrode separation and electrode material has been explained using a simple model involving anode heating by the emission current from a vaporized emitting site at the cathode. 16 Refs.

Primary Keywords: Impulse; Implosion; Vacuum Gap; Several Electrode Materials; Cathode Vapor; Anode Vapor; Anode Vapor Gap Closure; Modeling

COPYRIGHT: 1979 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1314
HIGH VOLTAGE BREAKDOWN IN AN OSD-4 POINTED EXPERIMENT
H. L. Hazen, M. C. Huber and E. M. Reeves
Harvard University, Cambridge, MA
No. NASA-CR-103085, 37 p (03/1973)
Availability: AD 707474 NTIS

An apparatus for pulsing a high speed transmitter having pulsed delay times in the nanosecond range. The combination of solid state and spark gap devices provides protection against high voltage arcs for both transient and power follow-through conditions. (Author)

Primary Keywords: Electrical Faults; Oscill. Solid State; Transistors; Circuit Protection; Electronic Modules; High Voltages

1315
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
HIGH VOLTAGE BREAKDOWN STUDY
Authors Unknown
Ion Physics Corp., Burlington, MA 01803
ECOM Report No. ECOM-02334 (06/1977).
Availability: AD 711556 NTIS

This is the final report on a series of carefully controlled experiments designed to obtain data on vacuum breakdown in a high voltage vacuum tube environment. A description of the apparatus used and precautions taken to provide adequate controls are included, as are results from many of the preliminary experiments. The controls are presented with the limitations and also the effect of dielectric breakdown. The breakdown with and without magnetic field (in various configurations) is presented. Since the literature was fragmented and contradictory, factorial design (the effects of parameter changes are studied) was chosen for the experiment. The factors to be varied, along with the parameter ranges of each, are identified and discussed. The statistical methods applied to the data are also presented and the resultant accuracy is discussed. Finally, each individual experiment is presented along with the significant results obtained. 42 Refs.

Primary Keywords: Insulation Strength; Breakdown With Magnetic Field; Tates Algorithm; Statistical Analysis

Secondary Keywords: Radar Detectors

1316
(BREAKDOWN STUDIES)
(Electrodes)
HIGH-CURRENT ANODES FOR HIGH POWERED XENON ARC LAMPS
C. S. Fox, M. P. Reine, Thomas and J. A. Schmidlein
US Army Electronics Command, Fort Belvoir, VA
USAEC Report On Task 17460-1000445-04 (08/1969)
Availability: AD 596478 NTIS

In-house studies were made on the failure mechanisms of the positive electrodes (anodes) in xenon arc lamps with 20 kw to 40 kw power ratings. New materials, geometrical designs and fabrication techniques were employed in experimental anodes and tested under operating conditions. Several new designs were tested and determined because of the need for higher power output. The report concludes that a few promising anode designs are worthy of further development. 20, 23-, and 30-kw-lamp units with various anode designs were bought from six manufacturers for evaluation. 2 Refs.

Primary Keywords: Electrical Anode; In-line Monitor; New Designs

Secondary Keywords: Gas Discharge

1317
(BREAKDOWN STUDIES; SWITCHES, CLOSINGS)
(Electrodes; Gas Cells; Materials)
INVESTIGATION OF ELECTRODE EROSION IN HIGH CURRENT ELECTRIC ARCS
P. Deininger
General Dynamics Co. Corp., San Diego, CA 92112
AFRL Report No. AFRL-58-0112 (04/1968)
Availability: AD 675185 NTIS

Experiments on electrode erosion due to magnetically driven high current arcs are described together with a review of the literature. The range of parameters is: arc current 2 to 30 kA, pressure in various gases up to 4 atm, magnetic field strength up to 6 MG. The arc travels in a uniform magnetic field between segmented rail electrodes. The self-magnetic field of the current feed rails is reduced to a negligible level. Measurements of the arc velocity are given. Test plates of various metals are placed between the electrode rails. They are traversed by the moving arc so that the plates are exposed to the anode attachment on one side and to the cathode attachment on the other side. Initial parametric studies have shown that the rate of electrode erosion increases with the gas and gas pressure. Among others, the least electrode erosion hydrogen, the strongest, with helium and argon being intermediate positions. Tungsten, molybdenum, and rhenium show the highest erosion rates. Tungsten, molybdenum, and rhenium show the highest erosion rates. Oxide layers on copper can decrease erosion at the cathode while they increase the tendency for erosion at the anode. Thin coatings of molybdenum on copper showed erosion for increased erosion resistance. Thermal and electrical properties of various electrode metals have been compiled. High-speed photos have indicated that the moving arc attaches in one or several simultaneous attachment spots at anode and cathode. 58 Refs.

Primary Keywords: Traveling Arc; Magnetic Field; Arc Velocity Measurement; Erosion Track; Triggering

1320
(SWITCHES, OPENING)
(Mechanical)
DEVELOPMENT OF A CURRENT LIMITER USING VACUUM ARC CURRENT COMMUTATION
C. W. Kimball, J. G. Gorman, F. A. Holmes, P. R. Emtege, J. V. R. Heberlein
Westinghouse Electric Corp., Pittsburgh PA
EPRI Report No. EPRI EL-1221 (10/1979).
Availability: EPRI EL-1221 FFPI

Phase 1 showed the feasibility of developing a current limiter using vacuum arc current commutation. In concept, the electrodes of a vacuum device would be separated during the fault current rise, and the subsequent application of a transverse magnetic field would cause the arc current to commute into a parallel capacitor and ultimately into a parallel current limiting resistor. The feasibility of commutating at arc current levels to 5.5kA was demonstrated. However, the parallel capacitance was prohibitively large at 300 microfarads. The objective of Phase 2 was to increase the commutation current of a single 72kV device while also reducing the value of the parallel capacitor. A 4-actuator 14-lead prototype vacuum device was designed, built and evaluated, and the major parameters varied were device geometry, characteristics of the parallel circuit, electrode actuation speed, waveform of the applied transverse magnetic field, point or wave of electrode separation, and the use of series connected vacuum interrupters. Progress can be determined by comparing the commutation levels with Phase 1. For the earlier 15kV circuit, the commutation level increased to 14.5kA for a parallel capacitance of 50 microfarads. In particular, commutation levels of 12kA (15kV, preferred) were observed in circuits where the transient recovery of 50kV approximated the transient associated with a 72kV circuit. A Phase 3 program is recommended aimed at further improving the device performance. 16 Refs.

Primary Keywords: Fault Current Limiter; Current Limiting Device; Arc Interruption; Vacuum Switch

Secondary Keywords: Vacuum Interrupter; Circuit Breaker
EPRI-EL-1221 1979 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED
WITH PERMISSION

1321
(SWITCHES; EXPLOSIVE)
(Explosive)
METHOD OF UTILIZING SPARK-CAP FOIL SWITCHES IN DETERMINING DETONATION VELOCITIES OF SOLID EXPLOSIVE MATERIALS
G. W. Carter
Lawrence Livermore Lab., Livermore, CA 94550
(03/1974)
AVL 161-1010-1 Date: 05/26/97 NTIS

Primary Keywords: Detonation Velocity; Instrumentation; Electric Switches
Secondary Keywords: Spark Cap Foil Switches

1323
(MECHANICAL; STORAGE, MECHANICAL)
(Feriting, Techniques)
THE 1969 SCIENTIFIC-TECHNICAL CONFERENCE ON HOMOPOLAR GENERATORS
B. A. Al'kin et al.
Izdat. Nauk. i Tekhn. Publ. Ser. 250-250-70 (05/1970)
Trans. from Izdat. Vysshikh Uchebnykh Zavedeniy 7, 802-804 (1969)
Availability: AD 710255 NTIS

At a conference on homopolar generators, 35 reports were heard and discussed. Some of the topics covered were the questions of generator design theory, descriptions of the latest homopolar generator designs and their types, the problem of sliding contacts, merits of these generators and their practical prospects in electrochemical and electrical industries.

Primary Keywords: Homopolar Generator; Design Considerations; Charge Generation; Self-excitation; Liquidmetal Contacts

1324
(SWITCHES; CLOSINGS)
(Gas Cells; Pulse Asia)
SPARK GAP STUDIES
C. Levy
LECO, Fort Monmouth, NJ 07703
AFRL Report No. 2456 (04/1974)
Availability: AD 501285 NTIS

Tests on measurements were made using copper-tungsten as an electrode material. The erosion rates for this material were far greater than the rates for carbon-tungsten electrodes, also shown in the report. Tests were performed with and without saturable reactor cores and different voltage triggering schemes were evaluated. At a voltage of 1000 V across the gap, the erosion rate from 0.4 micrometers/second to 1.5 micrometers/second was achieved by compressed-air cooling of the electrodes. 11 Refs.

Primary Keywords: Copper-Tungsten; Ion Rates

1325
(PULSE GENERATORS)
(Marx)

HIGH-VOLTAGE PULSE VOLTAGE GENERATOR
I.I. Kalyatskii, V.I. Kurets, and V.I. Sazanov
FID: Wright-Patterson AFB, OH
No. FID-ID(RS)-100-79, 3p (12/1979).
Availability: AD-A087 88/3
NTIS

No abstract available.
Primary Keywords: Pulse Generators; Spark Gaps; High Voltage;
Translations: USSR
Secondary Keywords: Arkad'ev Marx Generators; Marx Generators;
NTISODDXA; NTISFNLR

1327
(POWER CONDITIONING)
(Pulse Transformers)

AN IMPROVED PULSE TRANSFORMER FOR HIGH-VOLTAGE APPLICATIONS
T.F. Turner
Stanford University, Stanford, CA 94305
Technical Report FL-Ag. 609 (05/1959).
Availability: AD 219114
NTIS

A method of designing high-voltage pulse transformers using less core material than conventional methods is presented. This method creates a constant gradient along the windings. Leakage inductance is reduced, but distributed capacitance is increased. 2 Refs.
Primary Keywords: Pulse Transformer; Conventional Design; Constant Gradient Design; High Efficiency; Core Material Savings

1329
(DIAGNOSTICS AND INSTRUMENTATION; BREAKDOWN STUDIES)

(Voltage; Surface Flashover)
ELECTRO-OPTICAL MEASUREMENTS OF SOLID INSULATOR SURFACE FIELDS AND SURFACE CHARGING IN VACUUM
D.M. Mylop, J.E. Thompson and T.S. Sudarshan
University of South Carolina, Columbia, SC
GCR Report No. GCR 87-293 (04/1980).
Availability: GCR 87-293
NTIS

Electro-optical measurements of the electric field along insulator surfaces and in the bulk of insulator materials have been made to determine the mechanisms associated with insulator surface flashover. The Pockels effect in KDP has been used in conjunction with a polarization interferometer and a pulsed laser to measure interfacial and bulk fields for KDP/vacuum interfaces. The results show that the solid insulator surface and bulk electric field distributions are spatially non-uniform. The electric field at the cathode is considerably enhanced while the field at the anode is reduced. The time evolution and steady state behavior of the insulator electric field distributions for DC, 60 Hz AC, and pulsed excitations will be presented. 17 Refs.
Primary Keywords: Surface Flashover; Bulk Insulator; KDP Crystal; Vacuum Interface; Non-uniform Electric Field

1331
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)

DESIGN OF EFFICIENT EXPLOSIVELY DRIVEN ELECTROMECHANICAL ENERGY CONVERTERS
S. Frankenthal, D.P. Manley and Y.M. Treve
American Science And Engineering, Inc., Cambridge, MA
Journal of Applied Physics, Vol. 36, No. 7, pp 2137-2139 (07/1965).
The conversion efficiency of a lumped-parameter, explosively driven electromechanical energy converter is studied. Numerical results of the study, which show the relationship among the device parameters required for unit conversion efficiency, are presented. 5 Refs.
Primary Keywords: Flux Compression Generators; Conversion Efficiency; Parameter Study; Design Suggestions
COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1335
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

INVESTIGATION OF OPERATING MODES OF HOMOPOLAR SHOCK GENERATOR WITH REGULATION OF EXCITATION FLOW
V.V. Kharitonov
FID Repro No. FID-ID RS-T-0662-80 (05/1980).

Trans. From: Elektrostroika (USSR) 12, 43-46 (December 1971) By Robert Potts
Availability: AD-A084849
NTIS

The calculation of transient processes in the excitation of a homopolar generator is examined. Several operating modes of the generator are analyzed, with emphasis on the regulation of the excitation. 5 Refs.
Primary Keywords: Homopolar Generator; Analysis; Excitation

1337
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Trigger; Capacitors)

GENERATION OF VOLTAGE PULSES FOR TRANSVERSE DISCHARGES
V.N. Ischenko, V.N. Litsitsyn and V.M. Starinskii
Institute of Semiconductor Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Instrumentation And Experimental Techniques, Vol. 20, No. 3, pp 725-727 (06/1977).
Trans. From: Priroba i Tekhnika Eksperimenta 3, 103-105 (May-June 1977).
This paper presents the results of an effort to increase above 10 J the pulse energy of a voltage-pulse generator described earlier. Another voltage-pulse generator is also reported which was assembled using second-hand 10 kV-11 condensers to yield 100 J pulses. The voltage-pulse generator is so designed as to provide a rate of rise of current into an ohmic load of 1.3E12 Amperes/4 Puffs.
Primary Keywords: Pulse Generator; Total Current; Energy Increase; Capacitor Improvement; Current Rate; Electrical Power Rating
COPYRIGHT: 1977 PLenum Press, REPRINTED WITH PERMISSION

1338
(BREAKDOWN STUDIES)
(Vacuum; Particles)

MICROPARTICLES IN HIGH-VOLTAGE ACCELERATOR TUBES
G.F. Griffith (1) and D.A. Eastham (2)
(1) Miskin College, New Concord, OH 43762
(2) Daresbury Lab., Daresbury, Warrington WA4 4AD, UK
Journal of Physics D: Applied Physics, Vol. 12, No. 9, pp 1105-1107 (09/1979).

Microparticles with radii greater than 2 microns have been observed in a high-voltage vacuum accelerator tube. The charge acquired by most of the particles is similar to the contact charging of a conducting sphere on a plane. 5 Refs.
Primary Keywords: Vacuum Breakdown; Microparticle; Charge Measurement; Velocity Measurement

COPYRIGHT: 1979 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1340
(PARTICLE BEAMS, ELECTRON)
(Generation)

A PULSED ACCELERATOR BASED ON THE 'ELIT-1' ACCELERATOR
L.P. Fominikh
Novomoskovsk Branch, GIAP
Instrumentation And Experimental Techniques, Vol. 18, No. 6, pp 1674-1675 (12/1979).
Trans. From: Priroba i Tekhnika Eksperimenta 6, 19-21 (November-December 1979).

A pulsed electron accelerator with an explosive-emission cathode is described which has been created on the basis of the 'ELIT-1' accelerator and differs from the latter in the use of transformer oil as the dielectric medium. This report is the charging voltage and storage capacitance of the accelerating. The beam current reaches 20 kA and energy of up to 1.5 MeV and a pulse length of approximately 25 nsec. 8 Refs.

Primary Keywords: Electron Generation; Explosive Emission Cathode; Elit-1 Accelerator; Oil Insulation; 1.5 MeV Beam Energy; 20 kA Beam Current; 25 ns Pulse Duration
COPYRIGHT: 1979 PLenum Press, REPRINTED WITH PERMISSION

1342
(DIAGNOSTICS AND INSTRUMENTATION)

(Data Transmission)
FIBER-OPTIC HIGH VOLTAGE ISOLATION OF CAMAC HIGHWAY

S.T. Lee and C.D. Moore
General Atomics, San Diego, CA 92121
Ref. CONF-771102-78, 7p (11/1979).
Availability: GA-A-15659
NTIS

Fault analyses of the Doublet III Machine predict that a horsetail 30 KV might accidentally appear on control and data acquisition wiring connected to CAMAC interface systems. Such an accident could cause damage in CAMAC and computer equipment as distant as the control room, with attendant possibility of personal injury to operators and experimenters. Protection for control room personnel and equipment has been provided in the form of fiber-optic data link systems installed in CAMAC parallel branch and bus serial highways. Both fiber-optic data link systems were designed, documented, and delivered by General Atomics, using vendor-supplied fiber-optic transmitters and receiver modules. (ERA citation 05:011007.)
Primary Keywords: Doublet Reactor; Camac System; Accidents; Control Systems; Data Acquisition Systems; Electric Arcs; Fault Tree Analysis; Hazards; Power Supplies; Safety

Secondary Keywords: ERDA-700209; Fiber Optics; NTISDE

1349
(SWITCHES; CLOSING; SAFETY)

(Gas Gaps; Self)
OVERVOLTAGE PROTECTION BY POINT-PLANE SPARK GAPS
W.R. Scarlet and K.B. Riepe
Los Alamos National Lab., Los Alamos, NM 87545
LA Report No. LA-94-1655 (10/1979).
Availability: LA-94-1655
NTIS

Electron-beam-controlled discharge CO₂/sub 2/ lasers, such as those used in the Antares and Helios laser-fusion drivers at the Los Alamos Scientific Laboratory, need protection against possible damage due to overvoltage. A passive point-plane spark gap has been developed and successfully used in the Helios power amplifiers which operate at voltages up to 300 KV. A gap of similar design is planned for use in the Antares power amplifiers which operate at 550 KV. These gaps must reliably hold off the normal discharge voltage, but break down with short delay in overvoltage, diverting the discharge current to a positive. A prototype of the Antares gap has been built and is undergoing a test. Parameters being investigated include voltage, polarity, gas mixture, gas composition, and gas pressure. Results of these measurements and the operational experience of the Helios gaps will be presented. 5 Refs.
Primary Keywords: Overvoltage Protection; Point-Plane Spark Gap; High Voltage; Voltage Polarity Variation
Secondary Keywords: Gas Laser

1350
(PULSE GENERATORS)

(Trigger)

SIX CHANNEL DIGITAL DELAY GENERATOR
C.C. Aseltine
Army Armament Research and Development Command, Aberdeen Proving Ground, MD 21005
APRL Report ARBRL-TR-02013 (01/1980).
Availability: AD-A183575
NTIS

A six channel digital delay generator is described which can provide delays of 1 microsecond to 10,000 microseconds. Delays are digitally generated and are designed to operate in high RFI areas such as those encountered in ballistic measurements. 0 Refs.
Primary Keywords: Delay Generator; Digital Delay Generator
Secondary Keywords: Pulse X-ray

**1351
(PARTICLE BEAMS; ION)**
(General on)
STUDY OF THE GENERAL PLASMA CHARACTERISTICS OF A HIGH POWER MULTIFILAMENT ION SOURCE

K. F. Schoenborg
Lawrence Berkeley Lab, Berkeley CA
LBL Report No. LBL-8940 (03/1979)
Availability: LBL-8940
NTIS

A general assessment of the steady state and time dependent plasma properties which characterize a high power multifilament ion source is presented. Steady state measurements, obtained via a pulsed electrostatic probe data acquisition system, in part include: A) The source electron distribution function consists of a bulk component of thermalized electrons comprising 82 to 97 percent of the total electron population plus a nonthermal high energy tail which is a monotonically decreasing function of energy, and contains a small but essentially negligible secondary electron population at energy values up to 15 eV. The maximum cathode current is 1.6 A. B) Steady state source performance address model follows ion pressure or charge theory assuming spatially uniform ionization. C) The multifilament source is presently the heart of the LBL Neutral Beam Facility, slated to provide inertial beam heating for science mode fusion experiments. A brief discussion on using the self-sustained source plasma parameters with overall neutral beam performance is included. 10 Refs.

Primary Keywords: Ion Beam; Neutral Beam; Electron Drift but on Function; High Energy; Inertial; Low Pressure; Discharge; Heavy; Electrostatic Probe

**1352
(PULSE GENERATORS; POWER CONDITIONING)**
(Capacitive; Pulse Transformer)

SURGE GENERATOR IN THE MEGAVOLT RANGE

V. T. McHughayev
FTD Report No. FTD-ID-REFSIT-1149-79 (03/1979).

Availability: AD-A265612
NTIS

A pulse generator designed to investigate the dielectric strength of accelerating tubes is described. The pulse generator is based on a capacitive store that is discharged into a pulse transformer with a subdivided core. An analysis is made of a unit designed to produce pulses of up to 1 MV. 3 Refs.

Primary Keywords: Pulse Generator; Pulse Transformer; Subdivided Core; Calculations; Megavolt Pulses

Secondary Keywords: Accelerator Tube

**1353
(PULSE GENERATORS)**
(Hand Tube)

A VARIABLE LOW FREQUENCY HIGH VOLTAGE GENERATOR USING VALVES WITH FIBRE OPTIC LIGHT GUIDE CONTROL

R. Miller, I.A. Black and V.N. Gray
Brighton Polytechnic, Houlescombe, Brighton, BN2 4GJ, UK
Journal of Physics E: Scientific Instruments, Vol 8, No. 9, pp 748-750 (09/1975).

This article describes a new method of generating low frequency high alternating voltages by modulating two high voltage DC supplies of opposite polarity. The modulation is accomplished by the use of triode valves situated at high voltage whose grids are supplied by control signals transmitted from the control circuit through fibre optic light guides. The first generator built is capable of driving a 1 mJ load at 10 kV peak over the frequency range DC to 10 Hz and 100 pF capacitor at up to 0.1 Hz. In order to increase the voltage and current ratings of the generator, a series parallel arrangement of valves may be used, with the appropriate control signals fed to the grid of each valve. Because the generator is relatively free from any electrical noise, it can be used to energize insulation samples in connection with partial discharge detection investigations. 8 Refs.

Primary Keywords: Bipolar Output; Capacitive Load; 10kV 1000 PPS; Triode Vacuum Tubes

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**1355
(POWER TRANSMISSION)**
(Transmission Lines)

CURRENTS AND CHARGES ON CYLINDERS IN A PARALLEL-PLATE TRANSMISSION LINE

T.T. Wu, M. Krook, R.H.P. King, D.J. Bleier and T.K. Sarker

Harvard University, Cambridge, MA

Final rept. 30 Jun 76-30 Jun 79 (07/1979).

Availability: AD-A079 597/1
NTIS

The final report summarizes the results of a 3-year model study to evaluate how well a parallel-plate transmission-line structure simulates an electromagnetic pulse with a plane-wave front. The amplitude and phase of the electric field inside the model simulator have been measured at two high frequencies for which representation of the field by the model does not apply. An approximate theoretical representation of the field is used to interpret the measured data. Differences between the actual and simulated desired traveling plane-wave field are discussed, and possible methods to improve the field in the simulator are offered. (Author)

Primary Keywords: Electromagnetic Pulse Simulators; Electric Fields; Electromagnetic Wave Propagation; Transmission Lines; Metal Plates; Parallel Orientation; Electromagnetic Pulses; High Power; Wavefronts; Plane Waves; Transverse Waves; Waveguides

Secondary Keywords: NTISLOGDA, NTISDLDAF

**1356
ELEMENTS OF HIGH-VOLTAGE NANOSECOND PULSE GENERATORS ON COAXIAL CABLES**

P.S. Antonov, A.G. Sterlinov, V.G. Tolmachev and Y.P. Usov

FTD, Wright-Patterson AFB, OH

No. FTD-ID-REFSIT-0374-79, 11P (03/1979)

Trans. From: Fizika Elektronika i Avtomatiki, No. 2, p 97 (1972) By

M.J. Fagan

Availability: AD-A080 825/3
NTIS

No abstract available.

Primary Keywords: Pulse Generators; High Voltage; Coaxial Cables; Transmission Lines; Insulators

Secondary Keywords: Nanosecond Pulses; NTIS000XA, NTISFMUP

**1359
(INSULATION; MATERIAL; BREAKDOWN STUDIES)**
(Solid; Plasma)

EXPERIMENTAL RESULTS ON PLASMA INTERACTIONS WITH LARGE SURFACES AT HIGH VOLTAGES

H. J. Grier
Lewis Research Center, Cleveland, OH
Mo. NASA TM 81421, 120 (03/1979).

Availability: LBL-8940
NTIS

Multikilowatt power levels for future payloads can be more effectively generated using solar arrays operating in the kilovolt range. This implies that large areas of the array at high operating voltages will be exposed to the space plasma environment. The resulting interactions of these high voltage surfaces with space plasma environment can seriously impact the performance of the payload system. Radiation interaction phenomena were studied in separate vacuum chambers 1.6 m diameter by 1.6 m high and sharper and a 2.5 m diameter by 2.5 m long chamber. The under-vacuum plasma cells had approximately 1/4 inch to the electrodes. The solar array panels, each with areas of 100 sq cm, were 1.7 m long by 1.7 m wide. Some of the solar panels were tested as a complete panel in the form of a 3x3 solar panel matrix. The results show that extensive metal shell sample tests results indicate that the metal shell is the primary candidate agent for high positive voltage breakdown, found to occur at high negative bias.

Primary Keywords: Acceleration; Components; Large-Space Electromagnetic Interactions; Solar Arrays; Surface Protection; High Voltage; Electrical Insulation; Plasma Density; Space Environment; Part 2; Spacecraft; Units

Secondary Keywords: NTISNAC

**1360
(BREAKDOWN STUDIES; INSULATION; MATERIAL)**

TESTS ON CHARGE ON TRANSISTORS IN TRANSFORMER OIL DUE TO VOLTAGE PULSES

W. W. Hwang
FTD, Wright-Patterson AFB, OH
No. FTD ID-REFSIT-0415-11, 33P (04/1979).

Availability: AD-A080 775/0
NTIS

No abstract available.

Primary Keywords: Electric Discharges; Transformers; Breakdown(Electronic Threshold); Oils; Pulses; High Voltage; Transistors

Secondary Keywords: NTISDODXA, NTISFMGC

**1361
(PARTICLE BEAMS; ION)**

(General)

ACCELERATION OF IONS BY A MODULATED ELECTRON BEAM

V.V. Velikhov, A.G. Lyman and N.A. Khizhnyak
Physico-Technical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR

Soviet Technical Physics Letters, Vol. 1, No. 7, pp 276-277 (07/1975).

Trans. From: Pis'ma Zhurna Tekhnicheskoi Fiziki 1, 615-618 (July 1975).

V. V. Velikhov's well-known ideas of collective acceleration of charged particles have led to the appearance of a large number of theoretical models of collective acceleration. In particular, we have proposed the acceleration of ions with the help of stationary electric fields produced in a straight electron beam of constant diameter propagating a conducting shield whose diameter varies along the axis of the system. It is shown here of the fact that the potential on the axis of the system increases with increasing ratio of the shield diameter to the electron-beam diameter. If the shield diameter changes periodically, then a sequence of potential wells is produced in the system and the dependence of the longitudinal component of the electric field on z is described by a periodic function. 1 Refs.

Primary Keywords: Collective Acceleration; Shield Diameter; E-beam Diameter; Potential Increase; Shield Diameter Modulation

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**1363
(SWITCHES; CLOSING)**

(LAS)

OPTICALLY ACTIVATED SWITCH

L.R. Lohry
Westinghouse Research and Development Center, Pittsburgh PA
AFAPL Fcst. No. AFAPL-TR-78-17 (04/1978).

Availability: AD-A080 557/1
NTIS

There has been a growing need for improved switches for very high energy pulsed power systems. Conventional switches such as thyristors, silicon diodes, and ignitrons have deficiencies in one or more of the desired parameters. A new solid state device, the Laser Activated Silicon Switch (LASS), appears to have the potential of meeting simultaneously all of the desired parameters including life and reliability of an extremely fast, high power, pulsed power switch. In its present form, the structure is similar to an optoelectrically gated thyristor, but it is triggered by a beam from a Nd-YAG laser. The laser trigger causes the switch to turn on orders of magnitudes faster than does an electrically gated device. This report describes the development and experimental verification of an analytic model of a high power LASS. Switches were fabricated and tested that achieved drift values greater than 40000 A/microsecond to peak currents of 25000 A for a pulse width of 40 microseconds. It is believed that the LASS indeed has the potential to meet the needs for a high power switch. 14 considerable research and development work is recommended. Recommendations are given for future work. 46 Refs.

Primary Keywords: Thyristor; Optical Triggering; High Repetition Rate Switches; Laser Activated Silicon Switch; Nd-YAG Laser; Experiments; Theory

1364
(INSULATION, MATERIAL)
(Solid)

STUDY OF THE EVOLUTION OF ELECTRICAL TREEING BY OBSERVATION OF LUMINOUS PHENOMENA AND DISCHARGE DETECTION

C. Laurent and C. Meyoux
Toulouse Univ. (France), Lab. de Genie Electrique.
No. PUGI-161, 66 (04/1978).
Availability: NBS-17374/3
NTIS

Results obtained from the observation of discharge characteristics for different treeing types as well as the time-dependent evolution of accompanying light phenomena were obtained. The experimental apparatus consisting of a microscope (400 X) and a camera, are described. The experimental procedure outlined. Results are presented concerning the occurrence of light emission due to the existence of discharge under the studied voltage conditions. The evolution of the light in the electrode gap was revealed through the use of an image intensifier. The same aging conditions as those reported in the literature for an air-filled gap were also observed.

Primary Keywords: Arc Discharges; Circuits; Light Emission;
Microchannels; Microphotographs; Amplifiers;
Electric Arcs; Imaging Techniques; Insulators;
Optics; Microscopes; Spark Gaps

Secondary Keywords: NTIS/NASA; NTIS/AFRL

1366
(DIAGNOSTICS AND INSTRUMENTATION; SYSTEMS)
(Systems)

P.G. De Biasi
Aerospacel Corp., El Segundo, CA 90245
Information No. 18-03015901-02-1, 27p (11/1979).
Availability: AD-A219 578/4
NTIS

Experiments conducted in the E-beam Laser Laboratory require the setting of gas flows, pressures, and voltages in a fast sequence. With a variety of sensors monitoring the system, the report describes the use of a CRAY-1 computer and other hardware, and details a BASIC program that senses and displays process variables digitally, reads in process parameters interactively, acquires data during an experiment, and computes and prints out test conditions and results.

(Author) Primary Keywords: Chemical Lasers; Pulsed Lasers; Electron Beams;
Trigger Circuits; Experimental Data; Data
Acquisition; Computer Applications; Operational
Amplifiers; Analog to Digital Converters; Computer
Programming; Microcomputers; Mixing; Hydrogen;
Fluorine

Secondary Keywords: Marx Generators; Chemical Pumping; Cromenco
Computers; BASIC Programming Language; Computer
Applications; NTIS/DCDA; NTIS/DOAR

1371
(POWER CONDITIONING)
(Systems)

HIGH POWER STUDY-POWER CONDITIONING

A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
AFAPL Report No. AFAPL-TR-76-101 (01/1976).
Availability: AD-A38724
NTIS

This paper summarizes the power conditioning portion of the high power study that was performed for the Air Force Aero-Propulsion Laboratory by the State University of New York at Buffalo. This effort defines the power conditioning system and critical component developments which will be required to interface the airborne 10 MW to 50 MW sources defined under separate study efforts with certain loads. Power conditioning systems are considered for use with magnetohydrodynamic generators and turbine driven alternators, both conventional and superconducting. The critical components required for each of the power conditioning systems are identified and then analyzed. The component analyses include estimations of development efforts necessary and of specific design requirements of components. The primary component considered are: transformers, switches, capacitors, and inductors. Weight algorithms are developed for each of these components. Following the component analysis, subsystems such as inverters and rectifier and filter packages are considered. The data for the various components and subsystems are then utilized for a comparison of the power conditioning techniques to be used with the various power sources. The weights and volumes of power conditioning systems for 3 point designs (variations of power, voltage, duty cycle and total run time) are derived. Finally a development program is outlined for the critical components. 12 Refs

Primary Keywords: Power Conditioning; High Power; Transformers; Solid State Switches; Capacitors; Inductors; Adiabatic Components

Secondary Keywords: Inverter; Converter; Light Weight Components

1372
(DIAGNOSTICS AND INSTRUMENTATION; REVIEWS AND CONFERENCES)

(Systems; Reviews)

HIGH VOLTAGE DESIGN GUIDE FOR AIRBORNE EQUIPMENT

M.G. Dunbar and J.W. Smibrook
Boeing Aerospace Co., Seattle, WA 98124
AFAPL Report No. AFAPL-TR-76-61 (06/1976).
Availability: AD-A29148
NTIS

This report supplies the theoretical background and design techniques needed by an engineer who is designing electrical insulation for high-voltage high-power components, equipment, and systems on aircraft. A literature survey and a substantial bibliography identify references that provide further data on the subjects of partial discharges, corona, field theory and plotting, voids, and processes for applying insulation. Both gaseous and solid insulations are treated. Creepage and liquid design criteria are included. Test and test equipment for high voltage insulation and equipment are defined. Requirements of test fixtures and procedures for high-voltage high power equipment are identified and illustrated by examples. Suggestions for high-voltage specifications are provided. Very few of the Military and Government specifications deal with system voltages above 10kv, thus most aircraft high-voltage specifications will have to be derived from the power industry specifications and standards produced by ASTM, IEEE, and NEMA. 12 Refs

Primary Keywords: Corona; Dielectric Withstanding Voltage; Electrical Insulation; High Voltage; Impulse Voltage; Partial Discharges; Paschen Law; Tracking
Secondary Keywords: Creepage; Field Theory; Utilization Factors; Test

1373
(SWITCHES; OPENING)

(Vacuum Gases; Magnetic Field)

INVESTIGATION OF FEASIBILITY OF VACUUM-ARC FAULT-CURRENT LIMITING DEVICE

A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226

EPRI Report No. EPRI-EL-538 (12/1977).

Availability: EPRI EL-538

NTIS

The feasibility of a vacuum arc fault current limiter was investigated in this project. This work is an outgrowth of the studies on the interruption of DC vacuum arcs that have been underway at the State University of New York at Buffalo for several years. In those studies a magnetic field has been used to interrupt the current flow in a vacuum arc. Design and construction of the device is such that electron current is forced to flow primarily radially outward from a central, relatively small rod-shaped cathode to a ring shaped anode. Control is achieved through the application of an axial magnetic field. Operation at current levels in the 5 to 10 kA range have been demonstrated for periods up to about 8 ms. The voltage of operation that has been demonstrated is less than required because of discharge paths that develop within the device in parallel with the desired path from the cathode to the anode. Significant progress was made in eliminating these discharge paths by using insulating shields between the anode and the cathode support structure. A brief study of fault current limiter commutation voltage requirements showed that the voltage appearing across a commutating device could be limited to a very reasonable value if the commutation waveform was properly controlled. Another study dealt with an investigation of the phenomena occurring during the initiation of arcs on gold and on copper cathodes. 8 Refs.

Primary Keywords: Vacuum; Current Interruption; Magnet; c Field; Waveform Control

COPYRIGHT: 1977 EPRI. REPRINTED WITH PERMISSION

1395
(ENERGY STORAGE; ELECTROSTATIC)

(Reviews)

PROGRESS IN RESEARCH ON ELECTROSTATIC GENERATORS

A.W. Bright
University of Southampton, Southampton, UK

Static Electricity, Paper 24, pp 285-296 (05/1971).

The requirements for high voltage generators are determined by the demands of physicists, engineers and industry. In this paper a review of the requirements is given together with the various techniques for designing electrostatic high voltage power supplies. The basic principles underlying the physics of electrostatic generators are considered, enabling one to envisage which method is more suitable for any particular requirement. An analysis of both the insulating carrier machine and the variable capacitor machine is presented with illustrations indicating the limitations and area for further research to meet specific power densities. The research associated with liquid insulated generators is reviewed, including both polar and nonpolar fluids. Developments are given for these generators using moving rotors with polar liquids (nitrobenzene) and for the streaming type IHD system with nonpolar liquids (hexane). The areas which require more study are the charge injection, charge collection and the associated bulk motion of the liquid. The latest achievements in these areas are presented. In the last section, a novel electrostatic generator employing dust laden air is described. 20 Refs.

Primary Keywords: Basic Principles; Insulating Carrier Generator; Variable Capacitor Generator; Polar Fluids; Nonpolar Fluids; Dust Laden Air

COPYRIGHT: 1971 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1402
(BREAKDOWN STUDIES)

(Gas; Electrical)

CONTRIBUTION TO THE THEORY OF IMPULSE BREAKDOWN

F.R. Dickey Jr.

Harvard University, Cambridge, MA
Journal of Applied Physics, Vol. 13, No. 12, pp 1336-1339 (12/1952).

The experiments of R.C. Fletcher on impulse breakdown are discussed and a simple theory for these experiments is developed by assuming that the breakdown consists of ionization and charge separation in a uniform field. The theory accounts reasonably well for the time lags and also explains the shape of the breakdown voltage transients. It indicates that measurement of the mean ionizing time for electrons in the gap should be possible. 3 Refs.

Primary Keywords: Gas Breakdown; Impulse Voltage; Theory; Breakdown Delay; Numerical Calculation

COPYRIGHT: 1952 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1412
(INSULATION, MATERIAL; ENERGY STORAGE, CAPACITIVE)

(Solid; Capacitors)

MODIFIED PLZT HIGH VOLTAGE DIELECTRICS

T.R. Guruge, S. Kumarakrishnan and E.C. Subbarao

Indian Institute of Technology, Kanpur, India

Forrellectronics, Vol. 27, pp 277-280 (01/1980).
Modified PLZ compositions are tested for the variation of their dielectric constant with respect to temperature and DC bias voltage. Calcium, strontium, and barium were added to replace lead and neodymium in place of lanthanum. Yttrium was also used, but it caused the formation of a cubic zirconia phase. A model based on the nearness of a material to the AFE-EE boundary is discussed. 7 Refs.

Primary Keywords: Multilayer Capacitor; Dielectric; Dielectric Constant; Variation With Temperature; Variation With DC Bias; Modeling

COPYRIGHT: 1980 GORDON AND BREACH, SCIENCE PUBLISHERS, INC.

1413
(ENERGY CONVERSION; ELECTRICAL; ENERGY STORAGE; INDUCTIVE; SWITCHES; OPENING)

(Charging Circuits; Systems; Explosive Fuses)

PULSED CHARGING OF CAPACITORS BY MEANS OF EXPLODING WIRES

L. Liebing

Institut für Plasmaphysik, Garching, FRG

Zeitschrift für Angewandte Physik, Vol. 26, No. 5, pp 345-350 (04/1969).
Exploding copper wires are used as circuit breakers in a circuit which pulse charges a fast energy storage capacitor from an inductive state. A two stage version of this circuit was constructed and tested with good results. Wire explosions confined in glass capillary tubes with outer diameters up to 1 mm were also studied. The load voltages in these experiments up to 40 kV and discussion of scaling the circuit up to handle 1 MV is presented. 13 Refs.

Primary Keywords: Pulsed Capacitor Charging; Exploding Wire; Inductive Energy Storage; Two-stage Charging

COPYRIGHT: 1969 BIRKHAUSER VERLAG

1415
(ARTICLE BEAMS, ION)
(Transport)

A HIGH VOLTAGE DEFLECTION CONDENSER OPERATED UNDER HIGH VACUUM CONDITIONS
G. Munzenberg (1), W. Faust (1), S. Hofmann (1), H.J. Schott (1) and K. Guttner (2)
(1) Gesellschaft Fur Schwerionenforschung, Darmstadt, FRG
(2) Physik Institut, Universitat Giessen, Giessen, FRG
Nuclear Instruments And Methods 166 (1979), pp 391-395 (12/1979).
Two electrostatic deflection condensers with plane electrodes of 50x60 cm²/surface area are operated under high vacuum conditions up to voltages of 620 kV across a gap of 15 cm. The condensers are operated in a parallel beam common cathode supplies. They are installed at a velocity filter SHIP at GSI Darmstadt. 10 Refs.
Primary Keywords: Ion Acceleration; Automatic Conditioning; Vacuum; Nuclear Reaction Products; Electrodes
COPYRIGHT: 1979 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

1421
(ENERGY STORAGE, CAPACITIVE; INSULATION, MATERIAL)
(Capacitors; Solid)

HIGH VOLTAGE POWER CAPACITOR DIELECTRICS RECENT DEVELOPMENTS
L. Mendelcorn (1), T.W. Dakin (1), R.L. Miller (1) and G.E. Mercier (2)
(1) Westinghouse Electric Corp, Pittsburgh PA
(2) Westinghouse Electric Corp, Bloomington, IN 47402
IEEE Proceedings Of The 14th Annual Electrical Insulation Conference, Boston, MA pp 250-255 (11/1979).
This paper discusses recent, now significant developments and evaluations for capacitor dielectrics. These dielectric fluids are isopropylbenzene, di-2 ethylhexyl phthalate plus trichlorobenzene, butylated monochlorobiphenyl oxide, phenyl xylid, ethane and benzyl n-octadecane, the film-paper dielectrics impregnated with these were extensively tested for thermal stability under voltage, and resistance to overvoltages with partial discharges. Considerable effort is now being devoted to practically significant partial discharge testing, to determine service reliability. Also included here is the evaluation of windings where one foil is narrower and folded at the edges to reduce the voltage stress at the foil edges. 9 Refs.
Primary Keywords: Capacitor Dielectrics; Film-paper Dielectrics; Fluid Properties
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

1428
(SWITCHES, OPENING)
(Explosive Fuses)

EXPLOSIVELY ACTUATED FAST-OPENING SWITCHES FOR VERY LARGE CURRENTS
R.I. Butler and B.W. Duggin
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND77-1458 (11/1977).
Availability: SAND77-1458
NTIS

In a series of eight experiments the authors investigated the use of high explosives to interrupt electric current by fast-opening switch mechanisms. The conducting link in seven of the experiments was a glass-lined plasma-filled cavity that was closed explosively. In the eighth experiment a ceramic link was driven into the liquid-vapor phase and expanded into a ceramic cavity. Resistance increases and resultant voltage spikes that correspond in time with the particle velocities of the collapsing walls were obtained. However, unknown high-resistance paths prevented voltage gradients greater than 1E5-1E6 V/m. 0 Refs.

Primary Keywords: Explosive Fuse; Glass Lined Plasma Filled Cavity; Foam Metal Link Ceramic Cavity

Secondary Keywords: Cylindrical Geometry

1429
(POWER CONDITIONING)
(Pulse Forming Networks)

PFN CHARACTERIZATION AND LIFE TEST

C.L. Bailey and C.W. White
TRW Systems Group, Redondo Beach, CA
AFAPL Report No. AFAPL-TR-75-69 (01/1976).

Availability: AD-A022958
NTIS

The feasibility of an integral, high temperature, pulse forming network (PFN) operating at a high pulse rate for short duration bursts has been demonstrated. The dielectric construction of the capacitor consisted of aluminum film and paper impregnated with Mobil's Synthetic Oil MS 1489 oil. Litz wire coils were wound on a high temperature foam core and the entire assembly was placed in a stainless steel enclosure. A U-shaped aluminum shield was used between the coils and the case to reduce eddy current heating. An overall weight of approximately 20 pounds for an energy storage density of 600 joules (30 joules per pound) was achieved in a design that operated for 1.5E5 shots at a pulse rate of 280 shots per second in 18 second bursts. The burst duration was limited by heating of the stainless steel enclosure due to eddy currents induced by the coil magnetic field. An aluminum case construction would greatly reduce this effect. 2 Refs.

Primary Keywords: PFN; Pulse Forming Network; High Energy Density Capacitors; High Energy Density PFNs; High Pulse Rate PFNs

Secondary Keywords: Integral PFN Design; High Temperature Capacitors

1431
(ENERGY STORAGE, CAPACITIVE; SWITCHES, CLOSING)
(Capacitors; Thyristors)

THE DESIGN OF A REPEATINGLY PULSED MEGAJOULE DENSE-PLASMA FOCUS
O. Zucker, W. Bostick, R. Gullickson, J. Long, J. Luce and H. Sahlin
Lawrence Livermore Lab, Livermore, CA 94550
UCRL Report No. UCRL-51872 (08/1975).
Availability: UCRL-51872
NTIS

This report describes a 1 pulse per second, dense-plasma-focus materials-testing device capable of delivering a minimum of 1E15 neutrons per pulse. Moderate improvements from existing designs is shown to be sufficient to provide 2E15 neutrons/sq. cm./sec to a suitable target. The average power consumption, which has become a major issue due to the energy crisis, is analyzed with respect to other plasma devices and is shown to be highly favorable. Also discussed is a novel approach to capacitor-bank and switch design with respect to repetitive-pulse operation. 17 Refs.

Primary Keywords: Capacitor Bank; Staggered-foil Capacitor; Silicon Controlled Rectifier

Secondary Keywords: Dense Plasma Focus; Liquid-dielectric Switch

1432
(POWER CONDITIONING)
(Pulse Transformers)

A THREE MEGAVOLT TRANSFORMER FOR PFL PULSE CHARGING

G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 4211-4213 (06/1979).

High voltage pulse transformers powered by low voltage capacitor forming transmission lines (PFL) up to the one megavolt range. A new transformer has been developed which will operate up to three megavolts in a PFL charging application. This transformer establishes the feasibility of multimegavolt operation and retains the features of compactness and high energy transfer efficiency that has been characteristic of lower voltage systems. This report includes a description of the physical features of the transformer, its electrical characteristics and a discussion of the operational results. 8 Refs.

Primary Keywords: Air Core Pulse Transformer; Megavolt Range; High Efficiency; Spiral Strip Design

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

1433
(BREAKDOWN STUDIES)
(Solid, Electrical)

CALCULATION OF ELECTRIC FIELD BREAKDOWN IN QUARTZ AS DETERMINED BY DIELECTRIC DISPERSION ANALYSIS

W.T. Lynch
Bell Labs, Murray Hill, NJ 07974
J. Appl. Phys., Vol. 43, No. 8, pp 3274-3278 (08/1972).
A breakdown field of 1.0E7 v/cm has been calculated using classical theory of electron energy loss. Dielectric dispersion curves were used to relate longitudinal optical phonon modes to electron energy loss via interaction of these two processes. The dominant mode was seen to be the 0.153 meV phonon mode. The breakdown calculation is also in good agreement with breakdown fields in SiO₂ sub 2, which also has optical modes that are strongly localized. 20 Refs.

Primary Keywords: Longitudinal Optical Phonon Modes; Electron Energy Loss; Nonrelativistic Electrons

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1442
(BREAKDOWN STUDIES)
(Gas, Electrical)

FORMATION OF NANOSECOND SPARKS IN STATIC BREAKDOWN OF A GAP

G.A. Mesyats and G.S. Korshunov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 13, No. 4, pp 483-487 (10/1968).
Trans. From: Zhurnal Tekhnicheskikh Nauk, 38, 666-684 (April 1968).

An examination is made of the limits of applicability of relations obtained on the basis of the Renge-Meizel theory of the static breakdown of air gaps (0.005 to 5.5 cm) under pressures of 1-6 atm. The time resolution of the recording apparatus being 1E-10 sec. It is demonstrated that the experimental results agree well with this theory for spark processes of duration t < 1E-6 sec. 0 Refs.

Primary Keywords: Static Breakdown; Nanosecond Resolution; Renge-Meizel Theory; Experiment; Theory; Variable Gap Spacing; Variable Pressure; Several Electrode Materials; Air Gaps

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1445
(PARTICLE BEAMS, ELECTRON)

(Generation)
OPTIMIZATION OF A HIGH ENERGY REB GENERATOR AND CONTRIBUTED STUDY OF THE PULSED REB

C. Pitoiset
CEA Centre d'Etudes de Valduc, Is-sur-Tille, France
(12/1977).
Availability: CEA-R-4894
NTIS

The optimization of a high-power electron generator which has been designed and constructed in the Commissariat a l'Energie Atomique Laboratories is described. This device, consists of a Marx generator coupled with a low-impedance coaxial line with liquid dielectric (water), should deliver high power pulses (0.1 TM; 50 ns) in a vacuum diode with a suitable impedance. The report consists of the following parts: the optimization definition and the tests to obtain an optimum for the impedance. The study and realization of a new section in order to cut off the prepulse. The study of the extracted electron beam and its propagation. The present characteristics are peak voltage in the diode: 600 kV, peak current in the diode: 273 kA, electron pulse width: 80 ns, beam transported energy: 6.8 kJ (graphite calorimeter), maximum peak power: 0.135 terawatt. (Atomindex citation 09:412075). Primary Keywords: Electron Guns; Ampere Currents; Beam Extraction; Beam Transport; Diode Tubes; Electric Impedance; Electron Spectra; High-voltage Pulse Generators; Performance; Power Generation; Signals; Simulation; Spark Gaps

Secondary Keywords: IN FRENCH: ERDA-440300; France; Pulse Generators; NTISINIS; NTISNFR
Distribution Restriction: U.S. Sales Only.

1448
(PARTICLE BEAMS, ION)

(Generation)

HIGH-IMPEDANCE ION-DIODE EXPERIMENT ON THE AURORA PULSER
R.A. Meger (1), F.C. Young (1), A.J. Drobot (1), G. Cooperstein (1), S.A. Goldstein (1), D. Mosher (1), S.E. Graybill (2), G.A. Huttlin (2), K.G. Kerris (2) and A.G. Stewart (2)
(1) Naval Research Lab, Washington, DC 20375
(2) Harry Diamond Labs, Adelphi, MD 20783

Journal Of Applied Physics, Vol. 52, No. 10, pp 6084-6093 (10/1981).
Proton beams with currents >50 kA at 5 MeV in a <=160-ns FWHM pulse have been extracted from an ion diode operated on the Aurora pulser. This result corresponds to an efficiency (proton current/total current) of 20%, which compares favorably with numerical simulation. The simulation indicates that the ion current is enhanced over the Child-Langmuir value due to the increased electron lifetime in the diode. The proton beam directed onto a LiCl target provides a source of 1.8E12 neutrons/sr/pulse in the forward direction from the /sup 7/Li(p,n)/sup 7/Be reaction. 16 Refs.

Primary Keywords: Proton Beam; 50 kA Current; 5 MeV Energy; Experiment; Theory; Numerical Calculation
COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1477
(BREAKDOWN STUDIES)
(Gas; Electr. Gal.)
IMPULSE BREAKDOWN IN THE 1E-9-SEC. RANGE OF AIR AT ATMOSPHERIC PRESSURE
R. C. Fletcher
Massachusetts Institute of Technology, Cambridge, MA
Physical Review, Vol. 76, No. 10, pp 1501-1511 (11/1949).

The formative lag of spark breakdown has been measured over the range from 1.5 to 1000 sec. using transmission line circuitry in conjunction with the time-discriminometer. It was found to be a function of the applied voltage independent of gap width for the stronger fields (high fields), but to increase for decreasing gap widths for the weaker fields (low fields). A calculation of the formative lag is presented which is based on the assumption that it consists mainly of the time for a single electron avalanche to build up a space-charge field comparable with the applied field. This predicts the observed formative lag within the experimental accuracy of the measurements over the entire range used. The increasing lag times for decreasing gap widths for the longer times is interpreted as the transition from a single avalanche to a multiple avalanche mechanism of breakdown. The results of field where this transition takes place for a given gap width is computed and found to predict the observed critical fields within the experimental accuracy. The good agreement between theory and experiment enables a more reliable prediction than has previously been possible for the critical gap width above which the threshold field is determined by a single avalanche mechanism. A sharp drop in the rate of fall of the breakdown voltage is observed for the weaker fields. It is suggested that this may be a change in the mechanism of electron release from the cathode. 1 Ref.

Primary Keywords: Air Gap; Formative Lag; Low Field; Gap Spacing
Secondary Keywords: Spacing Independence; Low Field; Gap Spacing

COPYRIGHT: 1949 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

1482
(SWITCHES; CLOSING)
(Gas; Electr. Gal.)
LASER-CONTROLLED SWITCHING

J.-P. Prostev (1) and T.J. Davison (2)
(1) Sandia Labs., Albuquerque, NM 87115
(2) EG&G Inc., Belmont, CA
IEEE Journal of Quantum Electronics, Vol. QE-7, No. 9 (09/1971).

A new type of laser switching is discussed. The laser produces volume ionization in the path of a propagating streamer, increasing its velocity. Suppression of afterglow is thereby obtained with pressures near 1 atm. 5 Refs.

Primary Keywords: Laser-enhanced Switching; Volume Ionization;
Streamer Propagation; Velocity Increase;
Multichannel Operation

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

1483
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Electrical; Gas Gaps; Self)
STATISTICAL STUDY OF NANOSECOND BREAKDOWN DELAY IN NARROW GAS GAPS IN SUPERHIGH ELECTRIC FIELDS

G.A. Mesyats and Yu.I. Bychkov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1255-1260 (03/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1712-1719 (September 1967).

This paper studies the delay in breakdown $T_{\text{sub}} d/V$ in narrow air gaps 0.2-0.7 mm long for an electric field strength reaching 4.6 kV/cm and a rise time of 0.25E-9 sec. A specially developed instrument is used to record automatically a large number of breakdown delay times $T_{\text{sub}} d/V$ (up to 500-600). The distributions of the number of breakdowns are constructed as a function of $T_{\text{sub}} d/V$. It is shown that these distributions have a single maximum when the number of breakdowns is approximately 1E3. The number of maxima in the distribution increases when the number of breakdowns is greater than 1E3. The minimum time $T_{\text{sub}} d/V$ in the distribution is taken to be the time required for discharge to take place and is about 1-2 orders greater than the time required for the avalanche to increase to its critical size $T_{\text{sub}} d/V$. When the emission current from the cathode is increased, the mean time decreases to about $T_{\text{sub}} d/V$ because of the ultraviolet light of the spark and scratches on the surface of the cathode. It is shown that for $d/V > 7$ the probability of overvoltages, the probability that no electron will appear after breakdown, is less than unity. It is also shown that fluctuations in the number of secondary electrons prove to have a considerable effect on the formation of discharge. 16 Refs.

Primary Keywords: Breakdown Delay; Very High Fields; Fast Rise Time;
Critical Avalanche Size; Cathode Emission; Air Gap

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1485
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
INTERACTION OF CAPACITOR-BANK-PRODUCED MEGAGUSS MAGNETIC FIELD WITH SMALL SINGLE-TURN COIL

J.W. Shearer
Lawrence Livermore Lab., Livermore, CA 94550
Journal Of Applied Physics, Vol. 40, No. 11, pp 4690-4697 (10/1969).
Experiments on the production of high magnetic fields in single-turn coils by means of high-voltage capacitor banks are described. Fields as high as 3.5 megagauss have been produced. Numerical analysis of the interaction of this field with the metal wall shows that magnetic diffusion and wall compression are the principal interaction phenomena. In addition, experimental and theoretical evidence are presented for the emission of a vapor cloud by the wall into the magnetic field volume. Finally, a simple approximate method for calculating the early time history of the magnetic field and coil motion is shown to give reasonable agreement with experiment. 16 Refs.

Primary Keywords: 3.5 MG Field; Field-coil Interaction; Field Diffusion; Wall Compression; Vapor Cloud

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1499
(BREAKDOWN STUDIES)
(Lightning)

J.R. Lippert
AFPL, Wright-Patterson AFB, OH
AFPL Report No. AFPL-TR-78-191 (12/1978).
Availability: AD-A065A97
NTIS

A program was conducted to gain experience and document progress towards development of a concept for a Laser-induced Lightning Experiment (LILE). The purpose of the program was to develop a method for triggering natural lightning discharges using pulsed lasers and conventional optical lenses. The technique shows great promise in shortening the duration of lightning and in obtaining necessary lightning parameters. Data needed for more realistic lightning simulation tests and more definitive lightning transient analyses. To achieve the intended objective within the restrictions of availability, an experimental method was designed, a test facility designed and test site locations selected as soon as possible. Although the required climatic conditions did not develop during the experimental period, all other phases of the program were successfully accomplished and will facilitate future experiments. Small scale experiments were also performed to investigate spark gap triggering using laser beams, laser beam effects on electromagnetic fields, and laser power energy scaling. 11 Refs.

Primary Keywords: Lightning Triggering; Lightning Transient Analyses

1500

(PARTICLE BEAMS; ION)

(Target Interactions)
HATPIA: RESPONSE TO 500 KEV PROTON BEAMS AT INTENSITIES BELOW 1 GM/10 CM

T.R. Tucker (1), D. Mosher (1) and D. Hinshelwood (2)
(1) Naval Research Lab., Washington, DC 20375
(2) UCOB, Inc., Alexandria, VA 22304
NRL Memorandum Report 4443 (07/1979).
Availability: AD-A272616
NTIS

Stress-wave response of several materials to 500 kev, 1 kA/cm² proton pulses was monitored by shadowgraphy and interferometric methods. Results indicated the presence of both direct absorption and interaction plasma effects. Incident beam power densities of about 1 GW/cm² are necessary for plasma effects to dominate the interaction. 7 Refs.

Primary Keywords: Pulsed Ion Beams; Stress Waves; Interferometry

1501

(PARTICLE BEAMS; ELECTRON; PULSE GENERATORS; SWITCHES; CLOSING;
(Insulation; Material; Systems))

(Generation; Marx; Gas Gun; Electrical; Liquid)
SUMMARY OF THE HERMES FLASH X-RAY PROGRAM
T.H. Martin, K.R. Prestwich and D.L. Johnson
Sandia Labs., Albuquerque, NM 87115
Sandia Report No. SC-RR-69-421

Availability: SC-RR-69-421

The Hermes program produced significant information in the areas of Marx generator design, flash x-ray tube development, dielectric breakdown, and general flash x-ray machine design. As an outcome of the Hermes program, Hermes II was constructed and is the largest flash x-ray machine presently operating. This report summarizes the results of investigations in the areas mentioned and provides a general knowledge in the operation of megavolt flash x-ray machines which should be useful to the experimenters using these machines. 13 Refs.

Primary Keywords: 18-MV Marx Generator; Blumlein; Postpulse Suppression

Secondary Keywords: Flash X-ray Machines; Hermes II

1502

(PARTICLE BEAMS; ELECTRON)

(Generation)
A LONG PULSE, HIGH-CURRENT ELECTRON GUN FOR E-BEAM SUSTAINED EXCIMER LASERS

W.M. Clark and G.J. Dunning
Hughes Research Labs., Malibu, CA 90265
IEEE J. Quant. Electron., Vol. QE-14, No. 2 pp. 126-129 (02/1978).
A new kind of electron gun is described which has produced 5 microsecond beams at 130 kev and 2 A/cm² cm. Scaling estimates are presented which predict that this gun could operate at 400 kev and 10 A/cm² cm, beam parameters suitable for pumping excimer laser systems. For this application the gun has the advantages that the e-beam is nearly non-relativistic and the pulse width longer than that possible with other presently used guns. 9 Refs.

Primary Keywords: Electron Gun; High Energy; Secondary Electrons;

Excimer Discharge

Secondary Keywords: Multiturn H-195

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

1503
(BREAKDOWN STUDIES)

(Gas; Alpha Particles)

PREIONIZATION OF PULSED GAS LASERS BY RADIOACTIVE SOURCE

I.J. Bigio
Los Alamos National Lab., Los Alamos, NM 87545
IEEE J. Quant. Electronics, Vol. QE-14, No. 2 pp. 75-76 (02/1978).
An alpha-source of Americium 241 is used to preionize transverse electron-discharge gas lasers, enhancing the useful pressure range in a variety of gases. Of particular interest is the enhancement in electron-striking gases, which corroborates speculations on the role of negative ions in preionization. 11 Refs.

Primary Keywords: Americium 241; Electron Attaching Gases; Negative Ions

Secondary Keywords: Laser Preionization

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

1505
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

AN INTERNATIONAL COMPARISON OF HIGH VOLTAGE CAPACITOR CALIBRATIONS
W.E. Anderson, R.S. Davis, D. Petersons and W.J.M. Moore
National Bureau of Standards, Washington, DC
Final rep. (C1/1978).

Availability PB-286 114/2ST

The suitability of a commercially available, compressed-gas-insulated, high voltage capacitor for precise measurement of ac voltages has been examined by national laboratories in the U.S.A. and Canada. The voltage, temperature, and pressure dependences and the mechanical stability of the capacitor were determined. It was found that, by taking proper precautions, the device is competitive with other methods. As a result of this research, it was also found that high voltage capacitance measurements at the two laboratories involved are in agreement.

Primary Keywords: Capacitors; Calibrating; Comparison; High Voltage; Standards

Secondary Keywords: Arrhenius; NTISCOMBS

Distribution Restriction: PRL IN IEEE (INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS) TRANSACTIONS ON POWER APPARATUS AND SYSTEMS PAS-97, N4, H1277-1283, JULY/AUG 78.

1506
(PULSE GENERATORS)

PULSE, (Pulse), HIGH VOLTAGE, HIGH CURRENT NANOSECOND PULSE GENERATOR
J. Baile
Cobham Electronics Inc, Stamford, CT 06902

This note describes the development of a high voltage, high current, nanosecond pulse generator of small volume, low weight, and high efficiency. The pulse generator operates either single pulse or 15 Hz at a pulse width of 12 ns, pulse voltage of 30 kV, 1200 amp pulse is formed by discharging a 1.5 μF in a circuit with a triggered spark gap. A ringing choke circuit converts the Blumlein circuit to 30 kV, by transforming the 21 volt input.

Described are factors leading to the design approach. Problems encountered and preboard test results. 2 Refs.

Primary Keyword: Blumlein Line; Preboard; Charging Circuit

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

1531
(ENERGY CONVERSION, ELECTRICAL)

(Charging Circuits)

CHARACTERIZATION PROCEDURES FOR CHARACTERIZATION OF HIGH VOLTAGE SPARK SOURCES

A. Scheeline, R.J. Klueppel, D.M. Coleman and J.P. Walters
University of Wisconsin, Madison, WI 53706

Applied Spectroscopy, Vol. 32, No. 2, pp 224-238 (04/1978).

Methods for simulating high voltage spark sources are presented. Complete break patterns are computed given the source parameters, simulation is accomplished by the calculation of capacitor charging current and voltage as they relate to the output of the high-voltage transformer. A relative error of between 1 and 5% is achieved when the computations are compared to the experimental results. 14 Refs.

Primary Keywords: Spark Source; Charging Characterization; Simulation; Numerical Calculation; Capacitor Voltage; Charging Waveform

COPYRIGHT: 1978 SOCIETY FOR APPLIED SPECTROSCOPY

1532
(SWITCHES, CLOSING)

(Vacuum Tubes)

A NEW DESIGN FOR A HIGH-VOLTAGE DISCHARGE TUBE
L.C. Van Atta (1), R.J. Van De Graaff (1) and H.A. Burton (2)
(1) Massachusetts Institute of Technology, Cambridge, MA
(2) American Institute of Physics, New York, NY 10017

Physical Review, Vol. 53, pp 158-159 (02/1953).

A description is given of tests with a high voltage pulse of simple and rugged design. The tube consists essentially of a filter cylinder extending between the electrodes and evacuated to a pressure of 4E-5 mm Hg during operation. A potential of 300000 volts could be maintained on a section of tube 53 cm long. In spite of the fact that the voltage was initiated by discharge there was no case of puncture. A simple clear-cut mechanism for the initiation of discharge in vacuum (independent of field currents) is given together with confirming experimental evidence. On the basis there is proposed a method of screening the electrodes to prevent breakdown and permit the application of extremely high voltages to the tube. 3 Refs.

Primary Keywords: Vacuum Tube; Uniform Field; 300 KV Operating Voltage; Breakdown Mechanism

COPYRIGHT: 1953 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

1544
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

VARIATION OF DC ELECTRICAL BREAKDOWN OF VACUUM GAPS AND WITH VARIATION OF AIR PRESSURE IN THE RANGE 1E-9 TO 1E-2 TORR USING OFHC COPPER, NICKEL, ALUMINUM, AND NIOBIUM PARALLEL PLANAR ELECTRODES

R. Hacken and L. Altschuler
University of Sheffield, Sheffield, UK

Journal of Applied Physics, Vol. 46, No. 2, pp 627-636 (02/1975).
Breakdown potentials of vacuum gaps are measured over a wide range of air pressure using both direct and alternating (50 Hz) applied voltage and employing four different electrode materials. The air pressure is varied in the range 2E-9 - 2.5E-2 Torr for DC and 6E-7 - 2.5E-2 Torr for AC applied voltage. OFHC copper, nickel, aluminum, and niobium are used to fabricate the electrodes. It is found that the peak AC breakdown voltage is usually higher than the DC voltage for fixed electrode separation and fixed gas pressure. Under certain conditions considerable improvement in the insulating properties of the gap can be obtained in semivacuum. The improvement in the breakdown voltage of the gap is considerable and can reach up to 62% in some cases. The higher breakdown voltage is attributed to the increased work function of the metal-gas adsorbate system. 62 Refs.

Primary Keywords: AC Breakdown; DC Breakdown; Vacuum Breakdown; Gas Breakdown; Several Electrode Materials; Variable Gas Pressure; Breakdown Voltage Measurement

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1546
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

CAPODE- AND ANODE-INDUCED ELECTRICAL BREAKDOWN IN VACUUM

T. Utsumi
Cornell University, Ithaca, NY 14850

Journal of Applied Physics, Vol. 38, No. 7, pp 2989-2997 (06/1967).

The problems considered are whether the breakdown that occurs between two parallel-plane electrodes in a vacuum is an anode-induced or cathode-induced breakdown and what conditions determine which type of breakdown is dominant. The critical anode power density for an anode-induced breakdown and the critical cathode current density for a cathode-induced breakdown were measured and the experimental results are compared with predictions from theory of heat conduction. An analysis of these experimental results led to a conclusion for determining the type of breakdown that predominates as a function of separation between electrodes and of the thermal and electrical conductivities of the material of the electrodes. It was shown that there were four distinct regions of separation: two anode-induced regions, one cathode-induced region, and one transition region of both types. 8 Refs.

Primary Keywords: Parallel-plane Electrodes; Anode Initiated Breakdown; Cathode Initiated Breakdown; Transition Region; Critical Power Density

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1556

(SWITCHES, CLOSING; SWITCHES, OPENING)

(Gas Gaps, Materials; Gas Gaps, Materials)

ELECTRODE EROSION BY SPARK DISCHARGES

F.L. Jones
University College of Swansea, Singleton Park, Swansea, Wales

Journal of Applied Physics, Vol. 31, No. 3 pp. 60-65 (03/1950).
The effects of gas pressure, electrode separation, and electrode material on the rate of electrode erosion are studied. The author presents an estimate of the area of cathode hot spots based on the phenomena and predict that current densities of approximately 156 A/cm² cm⁻¹ are possible in short gaps. Electrode erosion is then estimated using the energy balance of these hot spots with an equilibrium temperature equal to the boiling point of the electrode material. An equation is set up to relate the volume evaporated per spark to the electrode material while neglecting chemical effects. 15 Refs.

Primary Keywords: Electrode Erosion; Very High Current Densities; Lateral Spread; Diffusion; Spare Charge Effects

Secondary Keywords: Diffusion Equation

COPYRIGHT: 1950 THE INSTITUTE OF PHYSICS

1557

(SWITCHES, CLOSING)

(Gas Gaps, Materials)

ELECTRODE EROSION IN PULSED HIGH-CURRENT DISCHARGES

G.S. Belkin and V.Y. Kiselev
Order Of Lenin Power Institute, Moscow

Soviet Physics-Technical Physics, Vol. 11, No. 2 pp. 280-283 (08/1966).
Experimental and theoretical results are presented relating electrode erosion to total energy passed through the gap. The authors obtain a formula for the amount of material melted at the electrode by assuming a plane heat source at the electrode surface and calculating $T(x,t)$, an empirically obtained constant is then used to relate the amount of material eroded to that melted. Comparison with experiment shows agreement to be good above a threshold current defined by the authors. 5 Refs.

Primary Keywords: Electrode Erosion; Molten Metal; Threshold Current; High Current

Secondary Keywords: Capacitor Bank Discharge

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1558

(SWITCHES, CLOSING; SWITCHES, OPENING)

(Gas Gaps, Materials; Gas Gaps, Materials)

ELECTRODE VAPOUR JETS IN SPARK DISCHARGES

C.M. Cundall and J.D. Craggs
University of Liverpool, Liverpool, UK

Spectrochimica Acta, Vol. 7 pp. 149-164 (12/1954).

The characteristics of electrode vapor jets are reported. Velocities of propagation, luminosity, and total material removed from the electrode are measured using a framing camera, spectrometer, and microbalance. The anode and cathode jets were analyzed for several voltages, currents, and electrode materials. 14 Refs.

Primary Keywords: Electrode Erosion; Luminosity; Metal Vapor Jets; Geometrical Considerations

Secondary Keywords: Framing Photography; Spectroscopy

COPYRIGHT: 1954 PERGAMON PRESS LTD.

1559

(BREAKDOWN STUDIES)

(Gas, Electrical)

EXCITATION OF THE SPECTRUM IN A SPARK DISCHARGE

S. Mandelstam

P.N. Lebedev Physics Institute, The Academy of Sciences of the USSR, Moscow

Spectrochimica Acta, Vol. 15 pp. 255-271 (01/1959).

This paper reports a hydrodynamic theory of the excitation of spectra in a spark channel. The channel is produced in air and is completely ionized, consisting mainly of doubly ionized nitrogen. Gas density is approximately 3.8 torr. Ion and electron temperatures are approximately equal at 40,000-50,000 degrees centigrade. 27 Refs.

Primary Keywords: Excited Spectrum; Shock Wave; Discharge-Arc Transition Region

Secondary Keywords: Spectroscopy

COPYRIGHT: 1959 PERGAMON PRESS

1560

(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Surface Flashover; Solid)

NEW DATA ON THE CREEP DISCHARGE AT THE SURFACE OF A DIELECTRIC

J.S. Brzozko, A. Konarzewski, A. Wojciechowska, E. Zukowski and J. Grudziński
Bialystok Div., Warsaw University, Bialystok, Poland

J. Phys. D, Vol. 8, No. 14 pp L175-L178 (07/1975).

Dielectric samples immersed in an intense electric field exhibit a creep discharge in the gas near the dielectric surface. The authors present measurements of the energy spectra of varying fields with peak values on the order of 1.0E3 V/mm and a frequency of 50 Hz. Organic glass and salt crystals were used as samples. High energy discharges were found to occur at 10 Refs.

Primary Keywords: Creep Discharge; High Energy Discharge; Lichtenberg Figure; Organic Glass; Seignette Salt

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS

1561
(BREAKDOWN STUDIES)
(Solid, Electrical)
ON THE THEORY OF ELECTRON MULTIPLICATION IN CRYSTALS

Seitz F.
Carnegie Mellon University, Pittsburgh PA 15213
Physical Review, Vol. 76, No. 9 pp 1376-1393 (11/1949).

The authors invest gate electron multiplication in strong electrostatic fields by import investigation. Statistical velocity fluctuations and few-electron interactions with non-polar lattice vibrations are seen to be important in electron multiplications. The non-polar interaction appear to make differences between von Hippel and Frohlich breakdown criteria less important than thought previously. 27 Refs.

Primary Keywords: Electron Multiplication; Non-polar Coupling; Statistical Velocity Fluctuations; Import Ionization
Secondary Keywords: Lattice Scattering; Polar Crystals; Non-Polar Crystals
COPYRIGHT: 1949 AMERICAN PHYSICAL SOCIETY

1562
(PARTICLE BEAMS, ION)

'Review'

OVERVIEW OF HEAVY ION FUSION PROGRAM IN U.S.A.

D. Keefe
Lawrence Berkeley Lab, Berkeley CA
J. Inertial N., LBL-7519 (02/1978).
Australian type: JEP-7519

This report prov des an overview of the Heavy Ion Fusion Program in the U.S. The author begins with a short summary of funding for Heavy Ion Fusion and proceeds to discuss briefly the state-of-the-art in heavy ion drivers. Advantages are discussed for fusion applications. A qualitative description is given of ion accelerator technology. 9 Refs.

Primary Keywords: Heavy Ion; Accelerator Systems Future Plans

1563
(BREAKDOWN STUDIES)

(Lightning)

RECOMMENDED PRACTICE FOR LIGHTNING SIMULATION AND TESTING TECHNIQUES

FOR AIRCRAFT

J. Phillipott
Culham Lab, Abingdon, Oxfordshire, UK
UKAEA Report No. CLM - R 163 (05/1977).
Availability: CLM-R163
Culham Laboratory, Abingdon Oxfordshire, H.M. Stationery Office

This paper is designed as a guide to simulating lightning effects on aircraft. The probable characteristics of lightning are presented, along with parameter ranges for duration of stroke, and total energy. Waveforms are given for simulating the effects of lightning stroke on aircraft components and systems with the most devastating waveforms indicated. 9 Refs.

Primary Keywords: Lightning Simulation; Current Ranges, Duration; Simulation Waveforms
Secondary Keywords: Aircraft Damage
COPYRIGHT: 1977 UK ATOMIC ENERGY AUTHORITY

1564
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)

SHUNTS AND INDUCTORS FOR SURGE-CURRENT MEASUREMENTS

Park, J.H.
Journal Of Research Of The National Bureau Of Standards, Vol. 39, pp 191-212 (09/1967).

The special requirements that must be fulfilled by a shunt intended to be used in surge-current measurements are explained. A tubular shunt with coaxial potential leads that meets these requirements is described, and factors affecting its design are discussed. A theoretical derivation of the 'skin effect' in this type of shunt at high frequencies is given in one of the appendices. The advantages of using mutual inductors for obtaining oscillograms of the rates of change of current during a surge are outlined, and several types of mutual inductors developed especially for this purpose are described. Theoretical derivations, given in the appendices, indicate that the concentric-tube mutual inductors described in this paper can be used to measure the high-frequency components of a current surge up to 70 nanoseconds with less than 10 percent error. Several shunts and mutual inductors of the designs described in this paper were constructed for use in the high voltage laboratory at the National Bureau of Standards. Their complete description and oscillograms showing results obtained with them are included. 7 Refs.

Primary Keywords: Pulse Current; Shunt; Current Transformer; Low Inductance; Coaxial Shunt; Mechanical Force; Di/Dt Measurement

1565
(BREAKDOWN STUDIES)
(Lightning)

SIMULATION OF LIGHTNING STRIKES TO AIRCRAFT

T.E. James and J. Phillett
Culham Lab, Abingdon, Oxfordshire, UK
UKAEA Report No. CLM - R111 (05/1971).

Availability: CLM-R111
Culham Laboratory, Abingdon Berkshire, H.M. Stationery Office

The authors report on a feasibility study of lightning testing of aircraft. A detailed description of the probable characteristics of lightning is presented, along with probable effects on aircraft. The design of a pulse generator required to successfully simulate a lightning stroke is considered in some detail, with attention given to the waveshape of the initial current pulse, voltage gradients, swept strokes, and constant current intermediate strikes. 62 Refs

Primary Keywords: Lightning Simulation; Lightning Waveforms; High Voltage Waveform Generator
Secondary Keywords: Aircraft Damage; Test Regulations
COPYRIGHT: 1971 UK ATOMIC ENERGY AUTHORITY

1566
(PULSE GENERATORS; PULSE GENERATORS; POWER CONDITIONING)
(Marx; LC, Pulse Forming Networks)

THE POWER BEHIND THE PULSE

H.T. Olson

Maxwell Labs Inc, San Diego, CA 92123

Optical Spectra, Vol. 10, No. 12 pp. 42-46 (12/1976).

This paper is a tutorial on the design and operation of Marx generators, and pulse forming networks (PFN) for coupling pulsed gas lasers. Many basic design parameters important to all applications are discussed, along with particular problem areas. The author stresses that the application engineer should interface closely with the designer to avoid potential problems with these systems. 6 Refs.

Primary Keywords: Marx Generator; Blumlein; LC Generator; Pulse Forming Network; Design Considerations; Pulse Transformer

Secondary Keywords: Laser Loads

COPYRIGHT: 1976 OPTICAL PUBLISHING COMPANY

1568

(DIAGNOSTICS AND INSTRUMENTATION)

(Miscellaneous)

DIGITAL TIMING UNIT FOR IMPULSE GENERATOR CONTROL

R. Minchin (1) and J. Farnell (2)

(1) Southern Electric Authority of Queensland, Brisbane, Queensland, Australia

(2) University of Queensland, St. Lucia, Queensland, Australia

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 3, pp 925-929 (05/1978).

This paper describes the design and construction of an impulse generator control unit which uses the counting of predetermined numbers of 10 MHz pulses to fix precise time delays for the control of a high voltage impulse generator and its associated recording equipment. Facilities for point on wave firing control are also provided. Particular attention is paid to problems arising from the high noise levels likely to occur in the high voltage laboratory environment. 2 Refs.

Primary Keywords: 10MHz Clock; 300 V Output Pulse; TTL Components; 10ms Interval; High Noise Environment

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

1576

(PULSE GENERATORS)

(Blumlein Lines)

HIGH AVERAGE POWER PULSER DESIGN FOR COPPER HALIDE LASER SYSTEMS

J.L. Peck, C.S. Liu, D.W. Feldman and L.A. Weaver
Westinghouse Research and Development Center, Pittsburgh PA

The Review Of Scientific Instruments, Vol. 49, No. 8, pp 1047-1049 (08/1977).

A circuit using two thyratrons is described which provides alternating polarity, high-current pulses at pulse repetition rates up to 20 kHz, suitable for operating copper halide lasers. The circuit is a modification of a Blumlein configuration in which two networks are charged in parallel and discharged in series, providing a voltage quadrupling effect when used with resonant charging. By triggering the thyratrons sequentially the current is reversed on alternate pulses, which greatly reduces axial cathode effects and extends the laser tube operating lifetime. The circuit can deliver up to 5 kJ average power at 15 kHz. 16 Refs.

Primary Keywords: Bipolar Pulse Generator; Blumlein Line; Resonant Charging; Thyratron; Rep-rate

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1593

(ENERGY STORAGE, CAPACITIVE; ENERGY STORAGE, CAPACITIVE; PARTICLE BEAMS, ELECTRON)

(Capacitors; Systems; Generation)

MAGNETICALLY INSULATED AND INDUCTIVELY CHARGED CAPACITOR FOR THE ATTAINMENT OF GIGAVOLT POTENTIALS

F. Winterberg

Nevada System, Reno, NV 89507

Nuovo Cimento, Vol. 20B, No. 1 pp 173-195 (03/1974).

The author presents a coaxial capacitor which could be charged to a gigavolt. The device employs magnetic insulation, but no superconductors are needed. It can be charged inductively and when discharged produces an intense electron beam. Scaling laws are considered with a view towards a machine several meters in size. The design problem, encountered in choosing a power supply are also discussed. 12 Refs.

Primary Keywords: Toroidal Capacitor; Very High Voltage; Very High Energy; Magnetic Insulation; Inductive Charging

COPYRIGHT: 1974 SOCIETA ITALIANA DI FISICA

1594

(ENERGY CONVERSION, ELECTRICAL; INSULATION, MAGNETIC)

(Transformers)

MAGNETICALLY INSULATED TRANSFORMER FOR ATTAINING ULTRAHIGH VOLTAGES

F. Winterberg

University Of Nevada System, Las Vegas, NV 89109

The Review Of Scientific Instruments, Vol. 41, No. 12, pp 1756-1763 (12/1970).

A high voltage transformer in which a high magnetic field inside a hard vacuum insulates against breakdown is proposed. The magnetic field is generated by electric currents in high field superconductors. Voltages up to 1E9 V may be attainable with such a system. A rectifier using high magnetic fields can transform the end voltage from AC to DC. The energy output at the terminal of the secondary coil can be extracted in the form of either an electron or an ion beam through the use of the field emission process. Potential applications include (1) high energy particle accelerators with beam intensities many orders of magnitude larger than in conventional accelerators or meson factories, (2) use in controlled thermonuclear fusion devices, and (3) continuous pumping of powerful lasers. The feasibility of this system will depend upon depressing the breakdown perpendicular to the direction of the high magnetic field. 5 Refs.

Primary Keywords: High Voltage Transformer; Magnetic Insulation; 1E9 V Output; E-beam Generation; Ion Beam Generation

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

- 1658
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN AT VERY LOW GAS PRESSURES
J.W. Leech
Queen Mary College, London, UK
British Journal Of Applied Physics, Vol. 6, pp 107-109 (03/1955).
Gas discharge phenomena at the pressures used in particle accelerators differ, in general, from those encountered in the normal discharge, since they occur at the pressures for which the mean free paths of the gas particles are comparable with the dimensions of the apparatus. It is the purpose of this note to examine, in terms of atomic collision data, two problems arising in connection with such low pressure discharges. The first problem concerns the validity of a proposed interpretation of an observed breakdown anomaly; the second is to estimate at what pressure breakdown would occur if it were due solely to ionizing collisions in the rarefied gas. 6 Refs.
Primary Keywords: Low Pressure; Long Mean Free Path; Electron Scattering; Paschen Curve Departure.
- COPYRIGHT: 1955 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 1659
(PARTICLE BEAMS, ELECTRON)
(Generation)
IMPULSE ELECTRON ACCELERATOR TO EXCITE LARGE GAS VOLUMES
B.M. Kovalevchuk, V.A. Lavrinovich, V.I. Manylov, G.A. Mesyats and A.M. Rybakov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 19, No. 6, pp 1731-1733 (12/1976).
Trans. From: Pribyot i Tekhnika Ekspertnaya 6, 125-127 (November-December 1976).
The description and characteristics of an electron accelerator to produce preionization in the active volume of a CO₂/laser are presented. The exit window of the accelerator is 30 x 300 cm, the density of the derived electron beam is 2 A/cm², for a 2E-sec pulse duration and 300-eV electron energy. 3 Refs.
Primary Keywords: E-beam Generation; Field Emission Diode; Low Current Density; Large Area Emitter; Pulse Generator
- COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1660
IMPULSE GENERATOR SPECTRUM AMPLITUDE MEASUREMENT TECHNIQUES
J.R. Andrews
National Bureau of Standards, Washington, DC
Final rept. (01/1976).
Availability: PB-264 328/65T NTIS
Various techniques that have been used to calibrate impulse generators and to measure spectrum amplitude are surveyed. A summary of experiments comparing the various techniques is included. The NBS measurement service for calibrating impulse generators is described.
- Primary Keywords: Pulse Generators; Spectrum Analyzers; Calibrating; Radiosondes; Oscilloscopes; Electromagnetic Interference; Fourier Transformation; Measurement Secondary Keywords: Reprints; Spectrum Amplitude; Fast Fourier Transform; NTISCOMBNS
- Distribution Restriction: PUB. IN IEEE TRANS. INSTRUM. MEAS. IM-25, N4 P380-384 DEC 76.
- 1661
(PULSE GENERATORS)
(Blumlein Lines)
HIGH-VOLTAGE PULSE GENERATOR FOR THE TWO-METER STREAMER CHAMBER OF THE JINR
N.S. Gladysheva, V.D. Volodin, Yu. Lukstintsh, M.I. Kozlov, Yu.A. Kerzhavina, P.S. Kuznetsov, A.T. Matyushin, V.T. Matyushin, V.S. Pak, N.S. Rudenko, V.I. Smetanin, V.I. Tsvetkov, A.A. Shatunov, E.A. Shevchenko and A.F. Yudin
Joint Institute Of Nuclear Research, Dubna, USSR
Instruments And Experimental Techniques, Vol. 18, No. 5, pp 1439-1440 (10/1975).
Trans. From: Pribyot i Tekhnika Ekspertnaya 5, 99-100 (September-October 1975).
A Blumlein generator with a pulse length which is controllable by changing the middle cylinder of the shaping line is described. The matching load of the generator is 35 ohm; the amplitude instability of the output pulse is < 1-1.5%. The generator is tested jointly with a working streamer chamber which has two gaps of 30 cm each for an output pulse length of 30.0 and 15.5 nsec. Experimental results obtained during the course of development and testing were presented. 5 Refs.
Primary Keywords: Pulse Generators; Blumlein Line; Variable Pulse Duration; 35 Ohm Impedance; Performance Test
- COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION
- 1662
PRESENT CAPABILITIES OF THE NBS AUTOMATIC PULSE MEASUREMENT SYSTEM
W.L. Gans
National Bureau of Standards, Washington, DC
Final rept. (01/1976).
Availability: PB-264 331/05T NTIS
In 1972, NBS began development of an Automatic Pulse Measurement System (APMS) consisting essentially of a minicomputer-controlled wide-band sampling oscilloscope. The objective of the work was to produce a fast general purpose pulse waveform acquisition and processing instrument with spectral capability in the frequency range dc-18 GHz. The purpose of this paper is to report the highlights of work done on the APMS from early 1972 to present. The experimental applications of the APMS now number in the hundreds. In the first category, calibration services are available for the following physical parameters: (a) Impulse generator spectrum amplitude; (b) Wide-band coaxial attenuation/gain; (c) Pulse generator transition time. Still in the experimental stage are measurements involving reflection coefficient and impedance, group delay, pulse distortion, and wide-band antenna characteristics.
- Primary Keywords: Pulse Analyzers; Automation; Oscilloscopes; Pulse Generators; Measurement
- Secondary Keywords: Reprints; Spectrum Amplitude; NTISCOMBNS
- Distribution Restriction: PUB. IN IEEE TRANS. INSTRUM. MEAS. IM-25, N4 P384-388 DEC 76.
- 1663
(PULSE GENERATORS)
(Systems)
TWO TANDEM PULSE GENERATORS PROVIDE WAVEFORM FLEXIBILITY
S. Jacobson
Caber Electronics Inc, Stamford, CT 06902
Electronics, Vol. 49, No. 11, pp 118-119 (05/1976).
The author proposes methods for producing complicated waveforms using two pulse generators connected in series, parallel or tandem. Problems and possibilities for each set up are discussed. 0 Refs.
Primary Keywords: Bipolar Pulse; Simple Arrangement; Tandem Connection; Series Connection; Parallel Connection
- COPYRIGHT: 1976 McGRAW HILL INC
- 1664
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN BETWEEN METAL ELECTRODES IN HIGH VACUUM. I. THEORY
F.M. Charbonnier, C.J. Bennett and L.W. Swanson
Field Emission Corp, McMinnville, OR 97128
Journal Of Applied Physics, Vol. 38, No. 2, pp 627-633 (02/1967).
A theoretical description of electrical breakdown across narrow gaps in high vacuum is presented under conditions for which surface cleanliness, work functions, gap geometry, and cathode surface roughness are well defined. Two basic initiating mechanisms are considered: (1) thermal processes initiated at both the anode and the cathode by the prebreakdown field-emitted electron current, and (2) mechanical processes resulting from the action of electrostatic stress on surfaces under the action of electrostatic stress produced by the electric field in the gap. In the case of thermal breakdown initiation, there exists a boundary between an anode and a cathode-initiated arc which can be expressed in terms of the factor gamma by which the gross field in the gap is enhanced at the tip of microscopic cathode protrusions. Solution of the heat conduction equation is given for the general case of DC or pulse gap voltages. This leads to a distinction between three ranges of pulse duration, and for each region, a simple analytical expression is given for the boundary value gamma_{1/2} which separates cathode- and anode-initiated breakdown. Based on the considerations presented here, some practical limitations of several electrode materials are given. 23 Refs.
- Primary Keywords: Narrow Gap; Several Electrode Materials; Several Geometries; Various Surface Roughness; Field Emission; Thermal Processes; Electrostatic Stress; Electrode Deformation; Theory
- COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 1665
(INSULATION, MAGNETIC)
()
MAGNETIC INSULATION AND MICROWAVE GENERATION
E. Dtt and R.V. Lovelace
Cornell University, Ithaca, NY
Applied Physics Letters, Vol. 27, No. 7, pp 378-380 (10/1975).
A relativistic self-consistent equilibrium is found for the magnetic insulation of a diode for conditions where the voltage rise time is long compared to the cyclotron period. Instability of the magnetic insulation equilibrium may allow high-power pulsed microwave generation in magnetron-like configurations. 10 Refs.
- Primary Keywords: High Voltage Diode; Magnetic Insulation Instabilities; Pulsed Microwave Generation; Magnetron-like Configurations
- COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 1666
(PARTICLE BEAMS, ION)
(Generation)
PROGRESS IN INTENSE PULSED ION SOURCES
S. Humphreys Jr.
Cornell University, Ithaca, NY 14850
Journal Of Vacuum Science And Technology, Vol. 12, No. 6, pp 1204-1207 (12/1975).
The authors consider the reflex triode as a source of ion beams. The possibility of magnetic insulation, foil anodes, and virtual cathodes are discussed, along with the effect on production efficiency. Several experiments performed at Cornell on ion beam production are reported. 23 Refs.
- Primary Keywords: Reflex Triode; Foil Anode; Virtual Cathode; Magnetic Insulation; High Efficiency
- COPYRIGHT: 1975 THE AMERICAN VACUUM SOCIETY
- 1667
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN BETWEEN METAL ELECTRODES IN HIGH VACUUM. II: EXPERIMENTAL
C.J. Bennett, L.W. Swanson and F.M. Charbonnier
Field Emission Corp, McMinnville, OR 97128
Journal Of Applied Physics, Vol. 38, No. 2, pp 634-640 (02/1967).
Experiments were performed in order to test the validity of the theory outlined in I. Significant theoretical parameters varied experimentally included electrode material, electrode geometry, and applied voltage pulse length. Electrode materials chosen included W, Mo, Cu, and Al. Gap spacings varied from a few tenths to a few thousandths of a centimeter at gap voltages up to 30 kV applied either continuously or in single pulses of 1 to 100 microsecond duration. For all electrode materials except Al, thermal processes are the primary initiating mechanism, and experimental observations agree with the theoretical predictions of I. With electrode materials of low tensile strength such as Al, the primary cause of electrical breakdown is due to the electrostatic stress produced by the high electric field. 4 Refs.
- Primary Keywords: Several Electrode Materials; Several Electrode Geometries; Impulse Voltage; Variable Pulse Length
- COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 1668
(SWITCHES, OPENING)
(Electrostatic Confinement)
A SIMPLE HIGH-VOLTAGE OPENING SWITCH USING SPOILED ELECTROSTATIC CONFINEMENT
I. Alexeff and F. Dyer
University of Tennessee, Knoxville, TN 37916
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 163 (09/1980).
We have initiated and sustained a plasma discharge at pressures well below the Paschen minimum by trapping electrons in orbits around a positively charged wire. Spoiling the trapping process terminates the discharge and opens the circuit in spite of high voltage applied. 5 Refs.
- Primary Keywords: Opening Switch; Below Paschen Minimum; Charged Wire; Electron Confinement Ground Wire; Discharged Wire; Electron Diffusion
- COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

1693
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN UNDER VACUUM CAUSED BY EVAPORATION AT THE ANODE
I.N. Sil'kov
Soviet Physics-Technical Physics, Vol. 13, No. 8, pp 1131-1132
(02/1969).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1385-1387 (August 1968)
Vacuum insulation works with strong electric fields E/n , so such discharges have very high E/n , where n is vapor density. Under these conditions, the electron energy is determined mainly by the potential difference through which the electron has passed, not by E/n . The number of ionizing collisions increases with n , and the electron energy soon reaches a value such that the ionization cross-section sigma_nu/n is large as the energy increases further. This gas discharge is therefore most likely to arise in a comparatively small volume directly at the anode, where n is large. In this paper, this process is compared with other secondary processes previously considered by other workers. 1 Refs.
Primary Keywords: Parallel-plane Electrodes; High E/n ; High Electron Energy; Small Discharge Volume; Theory
COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1699
(INSULATION, VACUUM)
(
PREVENTION OF ELECTRICAL BREAKDOWN IN SPACECRAFT

F.W. Paul and D.R. Burrowbridge
Goddard Space Flight Center, Greenbelt, MD
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 114-123 (09/1971).

The methods for preventing electrical breakdown problems in space flight are discussed. The techniques that have been employed by several successful users of high voltage systems in space are given in considerable detail. The fundamental elements are the avoidance of high electric fields and the avoidance of critical gas pressures. Selection of materials, scrupulous cleanliness, good mechanical design, solid pitting or complete venting, and frequent testing are the major steps to success. 1 Refs.
Primary Keywords: Vacuum Insulation; Cleanliness; Mechanical Design; Geometrical Considerations; Varying Gas Pressure
COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

1715
(INSULATION, MAGNETIC; ENERGY STORAGE, CAPACITIVE)
(Capacitors)
ATTAINMENT OF GIGAVOLT POTENTIALS BY MAGNETIC INSULATION

F. Winterberg
University of Nevada System, Las Vegas, NV 89109
Nature, Vol. 246, No. 5431, pp 299-300 (11/1973).

The author presents a design for a toroidal machine which can be charged inductively up to one gigavolt. Magnetic insulation keeps the inner conductor separated from the outer conductor. Application of the machine to controlled fusion and collective ion acceleration is discussed. 6 Refs.
Primary Keywords: Magnetic Insulation; Toroidal Capacitor; Very High Voltage; E-beam
COPYRIGHT: 1973 MACMILLAN JOURNALS LTD.

1726
(SWITCHES, OPENING)
(Explosive Fuses)

NETWORK FOR FAST COMMUTATION OF LARGE CURRENTS IN AN INDUCTIVE STORAGE DEVICE
V.G. Artyukh, L.G. Lisenko and S.A. Smirnov
Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 15, No. 1, pp 130-131
(02/1972).
Trans. From: Priroby i Tekhnika Eksperimenta 1, 119-120
(January-February 1972)

A network for commutating a current of up to 25 kA by means of an exploding wire is described. The instant of commutation is established with an accuracy of up to tenths of a microsecond and is independent of the wire cross section and of the magnitude of the compensated current. 4 Refs.
Primary Keywords: Exploding Wire; Inductive Energy Storage; Switch System; Triggered Opening Switch
COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

1727
(SWITCHES, OPENING)
(Thyristors; Electrical)

MECHANISM FOR NANOSECOND GRID CUTOFF OF HIGH-CURRENT DISCHARGES
I.I. Bokalevnik

Soviet Journal Of Plasma Physics, Vol. 6, No. 1, pp 119-121 (02/1980).
Trans. From: Fiz. Plazmy 6, 206-210 (January-February 1980)

Discharge currents of hundreds of amperes can be cut off in a few nanoseconds by a grid in a thyatron with a cutoff device (at average current densities up to approximately 1000 A/cm²) through the grid. The density of the cathode emission near the grid just before cutoff is estimated to reach 1612 cm⁻²/s⁻¹. The negative potential applied to the grid by the cutoff device is 1-2 kV during the cutoff. The effective range, even at these high grid potentials, is much smaller than the grid cell in a plasma of this density, so that the cutoff cannot be attributed to the effect of the grid potential on the discharge. 9 Refs.
Primary Keywords: Thyatron; Grid Structure; Current Cutoff; Discharge Contraction; Nanosecond Time Scale
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1728
(BREAKDOWN STUDIES)
(Expanding Wires)

MECHANISM OF DC ELECTRICAL BREAKDOWN BETWEEN EXTENDED ELECTRODES IN VACUUM
D.K. Davies and M.A. Biondi
Westinghouse Research and Development Center, Pittsburgh PA
Journal Of Applied Physics, Vol. 42, No. 8, pp 3069-3107 (07/1971).

A description is given of vacuum breakdown between extended copper electrodes in DC electric fields in terms of the relevant atomic-collision processes. The theory is based on a model involving avalanche amplification of current in electrode vapor generated by the evaporation of an anode macroparticle during its transit to the cathode. Calculations are presented of the dynamics, heating, and evaporation of the macroparticle leading to the production of the vapor medium in the interelectrode gap. The inferred copper vapor density distribution accounts quantitatively for the absorption of cascade radiation measured just prior to current amplification in the gap. Calculations of electron avalanche multiplication in the vapor lead to predictions of breakdown conditions in agreement with our observations. The predicted size of the anode macroparticle which initiates breakdown is, on the average, of the order of 1 micron in diameter. 55 Refs.
Primary Keywords: Copper Electrodes; Extended Electrodes; DC Breakdown; Atomic-collision Process; Theory
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1729
(INSULATION, MAGNETIC)
(
ON THE CONCEPT OF MAGNETIC INSULATION

F. Winterberg
University of Nevada System, Las Vegas, NV 89109
The Review Of Scientific Instruments, Vol. 43, No. 5, pp 814-815
(05/1971).

In a reply to a recent Note by Hirsch [Rev. Sci. Instrum. 42, 1371 (1971)], the several conditions for the feasibility of magnetic field insulation are presented. These conditions are quite similar to those to be satisfied for the magnetic confinement of an electron cloud. 5 Refs.
Primary Keywords: Feasibility; Simple Geometry; Dust Particles
COPYRIGHT: 1972 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1730
(SWITCHES, OPENING)
(Explosive Uses)

COMMENTS ON THE LIQUID-METAL MODEL FOR THE CALCULATED ELECTRICAL RESISTIVITY OF AN EXPLODING COPPER WIRE
A.J. Greenfield and N. Hirsch
Bar-Ilan University, Ramat-Gan, Israel
Physical Review B, Vol. 1, No. 10, pp 4186-4187 (05/1970).

An argument is presented against the use of a liquid-metal model in computing the resistivity of an exploding wire; calculations done by the authors show as much as an order of magnitude difference between liquid-metal model predictions and experimental data. 6 Refs.
Primary Keywords: Exploding Wire; Liquid-metal; Pseudopotential;
Charge Distribution; Calculation
COPYRIGHT: 1970 AMERICAN PHYSICAL SOCIETY

1731
(SWITCHES, OPENING)

EXPLODING WIRE PARTICLE SIZE BY LIGHT SCATTERING MEASUREMENT

F.N. Weber and D.D. Shear
Army Research and Development Command, Aberdeen Proving Ground,
No. BRL-R-1403, 26p (06/1968).
Availability: AD-673 710 NTIS

The reddish color seen in photographs of exploding copper wires was assumed to be due in part to the scattering of the blue and green wavelengths of the BH6 mercury lamp used. Accordingly, this scattered light was used to measure particle size by the dissymmetry method. The average value of the predominant particle dimension was found to be time dependent with a value of 1200 Å occurring 6 usec before the voltage peak. (Author)
Primary Keywords: Exploding Wires_Vaporization; Rayleigh Scattering_Particle Size; Mathematical Analysis; High-speed Photography; Voltage; Optical Instruments

1732
(BREAKDOWN STUDIES)
(Expanding Wires)

EXPLOSION OF BARE AND INSULATED COPPER WIRES
B.K. Bhat and I.B. Jordan
Carleton University, Quebec, Canada
Journal Of Applied Physics, Vol. 42, No. 2, pp 809-814 (02/1971).

8 Refs.
Primary Keywords: Bare And Insulated; Condenser Bank Discharge; Insulation Effects; Restrike Current; Restrike Delay; Explosion Zones In Voltage Length Plane
COPYRIGHT: 1971 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1733
(BREAKDOWN STUDIES; SWITCHES, OPENING)

(Expanding Wires; Explosive Fuses)

L.I. Ben-Yosef and A.G. Rubin
AFCRU, Bedford, MA 01730
Physical Review Letters, Vol. 23, No. 6, pp 289-290 (08/1969).
The authors present experiments done measuring liquid copper resistivity and calculations done using both a classical plasma approach and Ziman's theory of resistivity of liquid metal. The classical approach failed to adequately explain the experimental results, while close agreement was found using Ziman's theory with a structure factor based on the hard-sphere model. 7 Refs.
Primary Keywords: Liquid Copper; Resistivity; Degenerate Electron Gas; Ziman's Theory
COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS

1734
(BREAKDOWN STUDIES)

TEMPERATURE OF THE RESTRIKE CHANNELS OF EXPLODING WIRES
S. Lundström and A.E. Viestö
Institutet För Högspänningsforskning, Uppsala, Sweden
Journal Of Applied Physics, Vol. 41, No. 12, pp 4830-4835 (11/1970).

13 Refs.
Primary Keywords: Restrike Channel; Plasma Temperature; Thermal Conductivity; Electron Density; Fully Ionized; Current Distribution
COPYRIGHT: 1971 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1753
(SWITCHES, CLOSING)
(Reviews)

SOVIET RESEARCH AND DEVELOPMENT OF HIGH-POWER GAP SWITCHES
S. Kassel and C. D. Hendricks
RAND Corp., Santa Monica, CA 90406
ARPA Report No. R-1333-ARPA (01/1974).
Availability: AD A004599

NTIS

The Tomsk Polytechnical Institute and the Institute of Atmospheric Optics of the Siberian Department of the Academy of Sciences, USSR, have been engaged in the comprehensive research and development of high-pressure gap switches for high-current electron accelerators. The work involves the establishment of broad theoretical foundations for the understanding of the physical phenomena associated with the structure and operation of gap switches; specification of the optimum operating characteristics such as current density, rise time, fraction of a nanosecond, and construction of prototypes. The theory based on the avalanche-breakdown principle specifies alternate modes of discharge behavior depending on the quantity of initiating electrons, applied field, gap width, and gap pressure. Triggered gap structures incorporating BaTiO₃/zub 3/ ceramics were built; these are capable of delivering pulses ranging in length down to 0.6 nanosecond and of maintaining pulse repetition frequencies of the order of kHz for peak currents in the kA range. Multielectrode air-spark gaps for accelerator power sources have also been developed for 100-kA currents with a jitter of less than 5 nanoseconds and without the necessity to adjust gap length. 11 Refs.

Primary Keywords: Gas Gap Switch; Parallel Switch; Multichannel Switch; Fast Switch
Secondary Keywords: Relativistic-Charged-Particle Beams

1767
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Reviews; Reviews)

INDUCTIVE STORAGE-PROSPECTS FOR HIGH POWER GENERATION
J.K. Burton, D. Conte, R.D. Ford, W.H. Lupton, V.E. Scherrer and I.M. Vitkovitsky
Naval Research Lab., Washington, DC 20375
2nd IEEE International Pulsed Power Conference Proceedings, pp 284-286 (06/1979).

Recent progress in the development of key elements of high power inductive storage systems makes it possible to generate high power pulses using energy storage systems (other than explosive generators) which include single-pulse inductive systems, hybrids (inductor/pulse line and inductive devices for steepening of the capacitor output) as well as inductive systems for generation of high power pulse trains. Prospects for further development of opening switches and storage systems suggest potential near-term payoff. Improvements based on such developments can be expected to impact system efficiency, compactness and operational convenience. 15 Refs.

Primary Keywords: Opening Switches; Pulse Compression; Rep-rated; Switch Performance Comparison

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1768
(ELECTROMAGNETIC COMPATIBILITY)

(Hardness)
INTERNAL SGENM AND ANALYTIC REPRESENTATIONS FOR THE SKYNET STRUCTURAL MODEL

R. Stettner and R.W. Marks
Mission Research Corporation, Santa Barbara, CA 93102
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 6, pp 4970-4976 (12/1978).

Internal excitation data from the Skynet exploding wire experiments have been compared with finite difference code particle pushing calculations. Comparison between data and calculations was, for the most part, within the expected uncertainty except for two sensors located in the same section of the satellite. For those two sensors a modeling discrepancy in this satellite section may be the source of disagreement. A simple model circuit model is shown to have very nearly the same electromagnetic character as the finite difference code model (and presumably the Skynet Structural model) for a realistic external excitation. Driver models for internal p-dot drivers are suggested. When these models are coupled with the circuit model they agree quite well with the corresponding p-dot driver or the finite difference code SGM mode. 7 Refs.

Primary Keywords: Exploding Wire Radiator Response Data; Finite Difference Code Model; Space Charge Limiting; Model Circuit Model

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1770
(SWITCHES, CLOSING)

Liquid Gaps, Self:
LOW PREPULSE, HIGH POWER DENSITY WATER DIELECTRIC SWITCHING
D.L. Johnson, J.P. VanDevender and T.H. Martin
Sandia Labs, Albuquerque, NM 87125
2nd IEEE International Pulsed Power Conference Proceedings, pp 191-194 (06/1979).

Prepulse voltage suppression has proven difficult in high power, high voltage accelerators employing self-breakdown water dielectric switches. A novel and cost effective water switch has been developed at Sandia laboratories which reduces prepulse voltage by reducing the capacitance across the switch. The prepulse suppression switch uses energy formerly stored in the switch capacity and dissipated in the arc to be useful output energy. The switching technique also allows the pulse forming lines to be stacked in parallel and electrically isolated from the load after the line has been discharged. The switch consists of a ground plane, with several holes, inserted between the switch electrodes. The output line switch electrodes extend through the holes and face electrodes on the pulse forming line (PFL). The capacity between the PFL and the output transmission line is reduced by about 80 percent. The gap spacing between the output line electrode and the hole in the ground plane is adjusted so that breakdown occurs after the main pulse and provides a crow bar between the load and the source. Performance data from the Proto II, Mini and Ripple test facilities will be presented. 5 Refs.

Primary Keywords: Low Prepulse; Reduced Switch Capacitance; Ground Plane Electrode; Crowbar

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1771
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)
(Generation; Gas, Electrical)

LOW PRESSURE, HIGH VOLTAGE DISCHARGES FOR THE PRODUCTION OF ENERGETIC ELECTRON BEAMS

J.T. Verdayen
University of Illinois, Urbana IL
ARO Report No. 12528 1-P (07/1979).
Availability: AD A074556

NTIS

The fundamental theories of gas discharges offer widely varying predictions for the relative power input to the negative glow. Calorimetric measurements have been made in a planar helium discharge of the power input to the negative glow relative to the total input power. These measurements show that the limiting efficiency of devices working in this region (e.g. hollow cathode lasers) is approximately 30-40%. To aid in the interpretation of the experimental results a simplified theoretical model was derived. 9 Refs.

Primary Keywords: Gas Discharge Theory; Energetic Electron Beams; Negative Glow
Secondary Keywords: Hollow Cathode Lasers

1774
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

NEW DERIVATION OF THE VACUUM BREAKDOWN EQUATION RELATING BREAKDOWN VOLTAGE AND ELECTRODE SEPARATION

A. Maitland
University of Manchester, Manchester, UK
Journal Of Applied Physics, Vol. 32, No. 11, pp 2399-2407 (11/1961).
An analysis of the published measurements of breakdown voltage for various gap lengths for uniform and approx. Maxwell uniform fields shows that the results may be represented by the breakdown equation $V = Cx^{1/\alpha}$ and that the values of alpha lie in the range 0.1 to 1.1 with a mode of 0.7. A theory is developed which leads both to a breakdown equation of the same form and to a general expression to account for the range of values of alpha. This expression is confirmed for gaps up to 0.375 cm by direct experiment. The development is based on the postulate that an electron beam is emitted from the cathode, diverges, and bombards the anode to cause breakdown when a critical power flux is reached. The factor C is shown to include the critical power flux and to be related to both field and electrode separation. In support of the theory, the radii of craters produced on the anode are measured and shown to be related to the radius of an electron beam at the anode. Calculation shows the current carried by this beam to be of the order of 100 A. The values of the critical power flux obtained from the equation $V = Cx^{1/\alpha}$ and from end-of-rater data, respectively, agree within a factor of 1.5 and are of the order of 158 H cm/sun 2. To explain the observed phenomena, a multiple electron beam system is proposed. 36 Refs.

Primary Keywords: Vacuum Breakdown; Uniform Field; Voltage vs Gap Spacing; Experiment; Theory; 0.75 mm Gap Spacing; Field Emission; Anode Melting

COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1776
(REVIEWS AND CONFERENCES; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)

(Reviews; Pulse Transformers; Generation)
RECENT DEVELOPMENTS IN HIGH AVERAGE POWER DRIVER TECHNOLOGY

K.R. Prestwich, M.T. Buttram and G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
No. CONF-790723-6, 10p (11/1961).
Availability: SAND-79-0728

NTIS

Inertial confinement fusion (ICF) reactors will require driver systems operating at 10 to hundreds of megawatts of average power. The pulsed power technology that will be required to build such drivers is in a primitive state of development. Recent developments in repetitive pulse power are discussed. A high-voltage transformer has been developed and operated at 3 MV in a single pulse experiment and is being tested at 1.5 MV, 5 kJ and 10 pps. A low-loss, 1 MV, 10 kJ, 10 pps Marx generator is being tested. Test results from gas-dynamic spark gaps that operate both in the 100 kV and 700 kV range are reported. A 250 kV, 1.5 kA/cm exp 2 , 30 ns electron beam diode has operated stably for 1.6 x 10 exp 5 pulses. (ERA citation 04-045156)

Primary Keywords: Inertial Confinement; Power Supplies; Diode Tubes; Performance; Power Transmission; Spark Gaps; Transformers

Secondary Keywords: EPDA/70203; ERDA/700208; NTISDE

1777
(PARTICLE BEAMS, ELECTRON)

(Generation)

RIG FOR TESTING COLD CATHODES
E.N. Donets'kav and V.I. Pershin
KFA Atomic Energy Institute, Moscow, USSR
Availability: IEF-57(1978)

NTIS

A rig is described for testing various types of cold cathodes with 1 cm exp 2 area at 600 A total current, intended for use in the linear induction accelerator LIU-5/5000, which is an injector of facility for investigation of the collective acceleration method. The rig consists of an electron gun, nanosecond pulse generator, pumping system and beam monitors. Voltage pulses with a 100-120 kV amplitude and 35 ns duration were generated by adiabatic shaping line (DSL), made of 9 cables connected in parallel. The pulses from the DSL were fed in the gun vacuum diode through the transformer-inductor section. Increasing the voltage it is shown that it is reliable in operation and that the quick replacement is possible in case of cable failure. (Atomica citation 10-452579)

Primary Keywords: Ion Sources; Beam Monitors; Cathodes; Collective Accelerators; Electron Guns; Flowsheets; High Voltage Pulse Generators; Performance Testing; Pulse Shapers; Spark Gacs

Secondary Keywords: IN RUSSIAN: EFD4/433301; USSR; NTISINIS; NTISFHUR
Distribution Restrictions: U.S. Sales Only

1781
(ELECTROMAGNETIC COMPATIBILITY)

(Hardness)

THE EFFECT OF ELECTRON PRECHARGING ON SGEMP RESPONSE OF INSULATORS
W.A.J. Van Leer (1), B.C. Passenham (1), R. Stettner (1) and D.A. Fromme (2)

(1) Mission Research Corp, La Jolla, CA
(2) Lawrence Livermore Lab., Livermore, CA 94550
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 6, pp 5024-5029 (12/1979).

7 Refs.

Primary Keywords: Exploding Wire Radiator; 5 To 30 keV Electron Precharging; Dielectrics; SKYNET Satellite; Enhanced SGEMP Response

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

1785
(PARTICLE BEAMS; ION; PARTICLE BEAMS; ELECTRON)
(Generation; Transport)

INTENSE RELATIVISTIC ELECTRON BEAM INVESTIGATIONS
W.B. Doggett
North Carolina State University, Raleigh, NC 27607
AFCSR Report No. AFCSR-TR-79-1310 (09/1979).
Availability: AD A078515
NTIS

During this period research was performed at North Carolina State on collective ion acceleration in a vacuum diode geometry and in collaboration with a group from the Naval Research Lab on collective ion acceleration within an evacuated dielectric tube. Diode voltage and current wave forms along with transmitted beam energy and current were measured for a series of linear diameters and lengths. Beam energy loss was measured at a rate of approx 12% over the 8.3 and 15.1 cm long tubes. When the Alfvén limiting current was exceeded, including the creation of enough plasma for some current neutralization, scaling below the Alfvén limit the current propagates in a damped beam. The beam velocity was 1.4 cm/sec. Equipment for experimental work on electron beam propagation in evacuated magnetized pipes has been assembled and a theoretical study was made of intense electron beam equilibrium in magnetized pipes using a relativistic cold fluid model. 12 Refs.

Primary Keywords: Collective Ion Acceleration; E-beam Transport; Particle Calibration; E-beam Diagnostics

1785
(BREAKDOWN STUDIES)

Exploding Wires
EFFECT OF STRUCTURAL INHOMOGENEITIES IN EXPLoding WIRES
V.L. Budovskii, D.A. Zekstel'skaya, I.S. Kotova and I.P. Kuzhekin
Moscow Energy Institute, Moscow, USSR
Soviet Physics Technical Physics, Vol. 21, No. 6, pp 681-684 (06/1978).
Transl. From Zhurnal Tekhnicheskoi Fiziki, Vol. 48, pp 1219-1223,
June 1978

12 Refs.

Primary Keywords: Longitudinal Inhomogeneity; Early Melting; MHD; Seismic Instability; High Temperature Annealing; Melt; Melted Initial Perturbations In Melted Conductor

COPYRIGHT: 1979 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1797
(ELECTROMAGNETIC COMPATIBILITY)

(Hardness)

EXPLoding-WIRE PHOTON TESTING OF SKYNET SATELLITE
D.A. Fromme (1), V.A.J. Van Lint (1), R. Stettner (2), R.W. Macgurn (2) and B.M. Goldstein (2)
(1) Mission Research Corp., La Jolla, CA
(2) Mission Research Corp., Santa Barbara, CA
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1349-1357
(12/1978)

11 Refs.

Primary Keywords: Electrical Testing; Photon Testing; Exploding Wire; SKYNET; High Flux; Electromagnetic Response

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

1806
(SWITCHES, OPENING)

(Explosive Fuses)

OPTICAL FLASHES FROM DOUBLE WIRE EXPLOSION
C.Y. Kang, M.H. Lee and S.S. Lee
Korea Advanced Institute Of Science, Chongnyangni, Seoul, Korea
Canadian Journal Of Physics, Vol. 57, No. 9, pp 1439-1443 (09/1979).
Two optical flashes are obtained when two wires of different diameters connected in series are exploded. Calculations were done predicting the time between flashes and agreed closely with the experimental results. The flash separation time was found to be controllable depending only on the diameter and composition of the wires exploded. 9 Refs.

Primary Keywords: Double Wire Explosion; Time Dependent Resistance; Simulation; Numerical Calculation; Optical Flash

COPYRIGHT: 1979 NATIONAL RESEARCH COUNCIL OF CANADA

1809
(INSULATION, MAGNETIC)

(1)

PROPAGATION OF A MAGNETIC-INSULATION WAVE IN A COAXIAL LINE
A.V. Gordov
Soviet Physics Technical Physics, Vol. 23, No. 4, pp 463-465 (04/1978)
Transl. From Zhurnal Tekhnicheskoi Fiziki, Vol. 48, No. 4, pp 784-788
7 Refs.

Primary Keywords: Nonlinear; Vacuum Coaxial Line; Time-dependent;

COPYRIGHT: 1978 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1816
(ELECTROMAGNETIC COMPATIBILITY)

(Hardness)

SPONTANEOUS DISCHARGES AND THE EFFECT OF ELECTRON CHARGING ON SKYNET SGEMP RESPONSE
V.A.J. Van Lint (1), D.A. Fromme (1) and J.A. Rutherford (2)
(1) Mission Research Corp., La Jolla, CA
(2) TRT Corporation, San Diego, Calif.
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1293-1298
(12/1978)

13 Refs.

Primary Keywords: Electron Implantation; Spontaneous Electric Discharge; E-beam; SGEMP Response; Exploding Wire Radiator; Electric Potential Profile

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

1819
(BREAKDOWN STUDIES)

(Exploding Wires)

THE PHOTOEMISSION SPECTRUM FOR AN EXPLoding WIRE RADIATOR SOURCE

INCIDENT ON AL AND Au

D.J. Strickland and D.L. Lin
Science Applications Inc., Vienna, Virginia
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1571-1576
(12/1978)

Photons solutions to photoemission for an Al and Au are presented for the first time. The solutions were obtained by solving a Boltzmann transport equation. The results are compared with magnetic spectrometer data by Bernstein and results deduced by Fromme, et al. from backbiased diode data. Except for the spectrometer data for Al, the measured results do not agree well with our calculations. Good agreement, however, is achieved between our results and published data for both photoemission using line sources and for electron backscatter. 16 Refs.

Primary Keywords: Boltzmann Transport Equation; Soft X-ray Spectrum

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

1823
(PULSE GENERATORS)

(Control Systems)

A DIGITAL CONTROL SYSTEM FOR HV IMPULSE GENERATORS

J.E. Matthews and C.Y. Kong
University of Strathclyde, Glasgow, Scotland
Journal Of Physics E: Scientific Instruments, Vol. 11, pp 256-258
(03/1978)

A digital control system using TTL logic elements is described for use with a 1.4 MV impulse generator. The unit is fully programmable and records on magnetic tape the data obtained from breakdown studies of long spark gaps in a form suitable for on-line computer processing. The precautions necessary for operating solid state components in the hostile environment of a high-voltage laboratory include the use of optical links and battery-operated power supplies. 4 Refs.

Primary Keywords: Pulse Generator Control System; TTL Logic Control; Noise Reduction; Circuit Monitoring System

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1833
(PARTICLE BEAMS, ION)

(Generation)

HIGH-CURRENT-PULSED LINEAR ION ACCELERATORS

S. Humphries Jr.
Cornell University, Ithica, NY 14850
Journal Of Applied Physics, Vol. 49, No. 2, pp 501-512 (02/1978).

Possible methods are described for constructing ion linear accelerators in the 100-Mev range which have pulsed current outputs 100 times higher than currently available. A drift-tube design with insulating magnetic fields between the tubes is presented. The fields not only prevent electron flow, but also are essential for beam neutralization by low-energy electrons and transverse beam focusing. Preliminary discussions are given on accelerator design and construction, transverse focusing and beam neutralization, and control of the beam in longitudinal phase space. 35 Refs.

Primary Keywords: 100MeV Range; High Pulsed Current Output (10KA); Insulating Magnetic Field Drift Tube; High Efficiency (20%)

COPYRIGHT: 1978 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1834
(BREAKDOWN STUDIES)

(Gas, Optical)

HIGH-POWER PHOTOPREIONIZATION-STABILIZED CARBON DIOXIDE WAVEGUIDE LASERS OPERATING AT GAS PRESSURES OF UP TO 13 ATM

D.J. Brink and V. Hesson
National Physical Research Lab, Pretoria, South Africa
Journal Of Applied Physics, Vol. 49, No. 4, pp 2250-2253 (04/1978).

A simple photopreionization-stabilized waveguide laser is energized effectively by fast Blumlein-type pulsers and operates at pressures of up to 13 atm. The laser has an active plasma volume of 0.2 cm³ and provides 20 ns gain-switched pulses with beam energies of 10 mJ. The beam parameters and beam energies are more than an order of magnitude higher than those published previously; the peak power is enhanced by two orders of magnitude. 13 Refs.

Primary Keywords: Blumlein Pulser; High Pressure (13atm); 20ns Pulses; 10mJ Beam Energy

COPYRIGHT: 1978 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1842
(PARTICLE BEAMS, ELECTRON)

(Generation)

ELECTRON GUN FOR GENERATION OF SUBNANOSECOND ELECTRON PACKETS AT VERY HIGH REPETITION RATE

M. Weinfeld and A. Bouchoule
Ecole Polytechnique, Palaiseau, France
Review Of Scientific Instruments, Vol. 47, No. 4, pp 412-417 (04/1976).

In order to create and study trapped particle modes in a plasma column we have designed an electron gun which delivers packets with a repetition shorter than 1 nsec at energies of about 100 eV, and with a repetition frequency of several hundred megahertz. This gun is made with parts of a classical disk-sealed microwave triode. This paper describes the gun itself and the pulse generator used to modulate it. The results concerning trapped particle modes are shown in conclusion. 10 Refs.

Primary Keywords: Trapped Particle Modes; Magnetically Confined Plasma; Electron Plasma Potential Wells; Disk Sealed Microwave Triode

COPYRIGHT: 1976 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

1868
(SWITCHES, OPENING)
(Explosive Fuses)

EXPLOSIVELY ACTUATED 100 KA OPENING SWITCH FOR HIGH VOLTAGE APPLICATIONS
R.D. Ford and I. M. Vitkovitsky
Naval Research Lab, Washington, DC 20375
NPL Memorandum Report No. 3561 (07/1977).

Availability: AD A046798

NTIS

The role of opening switches for high power energy sources such as those required in particle beam research is becoming more important as the prospects for use of inductive storage techniques widens. The technology associated with these switches is also applicable to protection of electrical power systems from equipment where continually increasing voltage levels are being sought. A single shot modular opening switch capable of carrying currents up to 100 KA indefinitely and opening in a time of approximately 20 microseconds has been developed. Very low trigger jitter characteristics as well as its simplicity allow the switch to be used both in series and in parallel operation. This switch operates on the principle of an explosively generated pressure which radially drives paraffin to produce multiple ruptures in a cylindrical conductor. Current probes and fast frame photography were used to determine its mechanical performance characteristics such as the reproducibility of the opening time and the simultaneity of the rupturing of the conductor. Current and voltage probes have shown, for example, that a 16-segment switch develops 3 kV in 10 to 20 microseconds in the process of interrupting 100 KA current when used as a safety device, or 11 kV at 40 KA when used like an integral exploding wire fuse. 15 Refs.

Primary Keywords: High Speed Opening Switch; Inductive Storage

Secondary Keywords: Current Interrupter; Power Line Protection

1875
(REVIEWS AND CONFERENCES)
(Pulsed Power)

PULSED POWER FOR FUSION

T.H. Martin
Sandia Labs, Albuquerque, NM 87115
1975 IEEE Pulsed Power Conference Proceedings, Paper ID-1 (11/1976).

A review which traces the development of high power pulsed accelerators from the original inception at the Atomic Weapons Research Establishment, Aldermaston, England, for producing output through the low impedance accelerators, to the diode-aided accelerators for fusion will be given. Proto II is presently being assembled at Sandia and preliminary testing on the Marx has been completed. Examples of various techniques will be shown from Sandia accelerators. Requirements for accelerators capable of achieving fusion levels will be developed and problem areas outlined. The diode insulator flashover problem presently limits the maximum current available from the accelerators. 18 Refs.

Primary Keywords: Particle Accelerator; Proto II; Low Impedance; Fast Pulse

Secondary Keywords: Nuclear Fusion

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

1876
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)

PULSED HIGH POWER BRUSH RESEARCH

J.R. McNab

Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Components, Hybrids, And Manufacturing Technology, Vol. CHMT-1, No. 1, pp 30-35 (03/1978).

The successful utilization of homopolar machines for pulsed power applications requires the development of solid brushes capable of operating at very high current densities and slip ring speeds. Relevant data on the major current collection parameters are reviewed and, where possible, functional variations are suggested. Measured data on voltage drops, friction coefficients and wear rates at current densities up to 27.9 MA/m²sup 2/ (18 kA/sq in.) and slip ring speeds up to 360 m/s in air, hydrogen and carbon dioxide are discussed. 30 Refs.

Primary Keywords: Homopolar Generator; Solid Brush; Voltage Drop Measurement; Friction Coefficient Measurement; Wear Measurement; Several Atmospheres

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

1881
(INSULATION, MAGNETIC)
(

MAGNETIC INSULATION

I.D. Smith, P. O'A. Charonay and J.M. Grando

Physic International Co, San Leandro, CA 94577

1976 IEEE Pulsed Power Conference Proceedings, Paper IICB-1 (11/1976).

Magnetic insulation of short pulses in vacuum transmission line configurations has been studied analytically since it was successfully used in the AURORA generator. Criteria for its effectiveness have been derived for cases that are steady state and where the load current provides the magnetic field. Experiments are reported here in the 2 to 3.5 MV range. Criteria for insulation have been investigated; insulation has been demonstrated at applied fields of over 4 MV/cm, and preliminary results obtained for a coaxial line whose double transit time is longer than the pulse duration. 6 Refs.

Primary Keywords: Magnetic Insulation; Vacuum Transmission Line; Analysis; Experimental Results

Secondary Keywords: Pulse Fusion

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

1898
(BREAKDOWN STUDIES)

(Exploding Wires)

PURE ROTATIONAL HF LASER OSCILLATIONS FROM EXPLODING-WIRE LASER

W.W. Rice and R.C. Didurberg

Los Alamos National Lab, Los Alamos, NM

IEEE Journal Of Quantum Electronics (March 1977), pp 86-88 (03/1977).

We report 19 pure rotational HF laser transitions, 5 of which are new, for exploding-wire metal atom oxidant lasers. The laser operates at 100 Hz, pressures as high as 570 Torr, and a gas length of only 0.24 m. The laser pulses are 1-4 us duration and deliver 10E-4 J/pulse. 13 Refs.

Primary Keywords: HF Exploding Wire Laser; 19 Rotational HF Laser Transitions (5 New); F₁/sub 2 Pressure Up To 500 Torr; 1-4 Us Laser Pulse Length; 10E-4 J/pulse

COPYRIGHT: 1977 IEEE. REPRINTED WITH PERMISSION

1907
(BREAKDOWN STUDIES)
(Exploding Wires)

SKIN EFFECT IN EXPLODING-WIRE PHYSICS

P.V. Phung and D.O. Miles
Lockheed Palo Alto Research Laboratory, Palo Alto, CA 94324

Journal Of Applied Physics, Vol. 46, No. 10, pp 4487-4492 (10/1975).

This paper describes a method for calculating the current density in a cylindrical conductor under fast-pulse high-current conditions commonly encountered in exploding-wire studies. Due to extensive Joule heating, the transport property (resistivity-to-permeability ratio) of the conductor must be considered as it varies with current. Basic mathematical representation of the electrodynamical process is recast into a standard nonlinear diffusion problem. An approximate analytical solution is derived for the penetration depth as a function of time. A numerical solution for the early stages of explosion is also presented for the case of a gold wire in which the permeability is temperature independent and the transport parameter varies only with the resistivity. The effect of magnetic pitch on the solid-liquid transition is not included in this illustrative computation. 11 Refs.

Primary Keywords: Skin Depth As Function Of Time; Numerical Solution For Gold (constant Permeability)

COPYRIGHT: 1975 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1926
(PULSE GENERATORS)
(Capacitive)

HIGH VOLTAGE PULSED CIRCUIT FOR DICHROIC STUDIES

H.A. Glick
Univ of California, Riverside, CA

Review Of Scientific Instruments, Vol. 47, No. 1, pp 150-152 (01/1976).

A high voltage pulse generator using stacks of silicon-controlled rectifiers (SCR's) is described. Pulses of 2 kV were easily produced and applied to solutions for dichroic studies. The system is easily adapted for higher voltage pulses. 3 Refs.

Primary Keywords: Solid State; SCR Pulse Generator; SCR Switch; Series SCR Switch

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1927
(PULSE GENERATORS; SWITCHES, CLOSING)

(Trigger; Krytrons)

HIGH-VOLTAGE PULSE GENERATOR OFFERS VARIABLE DELAY AND ONLY 3-NS JITTER

R.H. Vandrie and G.M. Molan
Aeospace Corp, Los Angeles, CA 90009

Electronic Design, Vol. 24, No. 9, pp 86 (04/1976).

The large amount of jitter normally associated with thyratrons is reduced to 3 ns through the use of a cold-cathode tube. The circuit to do this along with some delay circuitry is presented. The generator can produce 4 kV pulses into 50 ohms with a rise time of 10 ns which can be triggered with delays from 0 to 10 microseconds. 0 Refs.

Primary Keywords: Trigger Generator; Multichannel Delay Generator; Krytron Switch; Delay Logic; Low Jitter; Fast Rise; Low Impedance

COPYRIGHT: 1976 HAYDEN PUBLISHING CO.

1937
(BREAKDOWN STUDIES)

(Electrodes)

STABILITY OF FIELD EMISSION AND MIGRATION PROCESSES PRECEDING DEVELOPMENT OF A VACUUM ARC

G.N. Fursel and G.K. Kartsev
Leningrad State University USSR

Soviet Physics Technical Physics, Vol. 15, No. 2, pp 225-232 (08/1970).

This paper gives the results of an experimental investigation of the migration processes leading to a change in the geometry of the cathode surface and preparing the way for vacuum breakdown. Field emission microscopes - Muller guns with tungsten single crystals - were used for the investigation. The changes in the surface of the tungsten cathode with time in relation to the temperature, residual gas pressure, electric field, and power dissipated by the emitted electron beam on the anode have been investigated. The residual gas pressure was varied from 10 to 5E5 mm Hg, and the temperature from room temperature to 2000 Deg.K. There is a significant relationship between the rate of formation of migrational irregularities on the cathode and the residual gas pressure, cleanliness of surface, and electron beam power. The probability of breakdown increased when the surface remained clean, the processes leading to breakdown took place in a wide range of pulse lengths (1E-3 - 10 sec). There is a considerable reduction in electric strength of the vacuum gap when the surface is contaminated. The rate of development of breakdown in the stage of transition to a highly conducting vacuum gap is several orders greater than the rate of development of the process in the preliminary stage. 12 Refs.

Primary Keywords: Field Emission; Migration Process; Cathode Geometry Change; Tungsten Cathode; Variable Temperature; Variable Gas Pressure; Variable E-field; Variable Power Dissipation

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

1946
(PULSE GENERATORS)

(Mark)

BODISTRAP CIRCUIT GENERATES HIGH-VOLTAGE PULSE TRAIN

L.H. Barnstiel
Massachusetts Institute of Technology, Cambridge, MA

Electronics, Vol. 48, No. 14, pp 95-97 (07/1975).

A 5 kV, 400 Hz pulse generator with a 100 ns rise time is built from 20 low voltage stages. The circuit was to be used in a six-channel instrument and needs only a low voltage power supply. 0 Refs.

Primary Keywords: Transistorized Marx; High Voltage; Fast Rise

COPYRIGHT: 1975 McGRAW HILL INC.

- 1961**
(PULSE GENERATOR)
(Miscellaneous)
PICOSECOND-PULSE SEQUENTIAL WAVEFORM GENERATION
H. M. Cronan
Sperry Research Center, Sudbury, MA 01776
IEEE Transactions on Microwave Theory And Techniques, (December 1975),
pp 1048-1049 (12/1975)
This short paper describes a novel method of generating a pulse sequence using step-recovery diodes (SRD's) shunting a transmission line. Individual pulses in the train may have rise times less than 60 ns with amplitudes greater than 10 V. The many potential applications of the device include a short RF pulse generator, and FM generator, and a high-speed word generator. 2 Refs.
Primary Keywords: Step-recovery Diodes (SRD's); Shunted Transmission Lines; 60ps Risetimes; 10V Amplitudes; N-section
COPYRIGHT: 1975 IEEE. REPRINTED WITH PERMISSION
- 1963**
(PULSE GENERATORS)
(Trigger)
PULSE AMPLIFIER CAN DELIVER OVER 500 V WITH FREQUENCIES TO 100 KHZ
D. L. Nutt
Stanford Research Institute, Menlo Park, CA 94025
Electronics Design, Vol. 20, pp 102 (09/1975)
The pulse amplifier presented takes a TTL input and outputs up to 500 volts. The circuit can handle frequencies up to 100 kHz and can drive capacitive loads. 1 Ref.
Primary Keywords: Optocoupler; TTL Level Input; Simple Design
COPYRIGHT: 1975 HAYDEN PUBLISHING CO.
- 1973**
(PULSE GENERATORS; SWITCHES; CLOSING; SWITCHES; OPENING)
(Circuits; Transistors; Vacuums)
ACCELERATION OF LONG HIGH-VOLTAGE PULSES
N. T. Gagin, V. N. Grido, V. A. Krestov and I. A. Nikulin
Instruments And Experimental Techniques, Vol. 17, No. 6, pp 1658-1669 (12/1974).
Trans. from: Priobry i Tekhnika Eksperimenta 6, 102-104 (November-Dec. 1974).
A generator of long high-voltage pulses is described which uses a tactic in a self-sustaining discharge mode. An output pulse amplitude of up to 5 KV is achieved. The time-shifted pulses are used to effect continuous variation of the pulse duration in the range from 2 to 100 microseconds. 2 Refs.
Primary Keywords: Tactic; Switch; Self-sustaining Discharge; Long Duration Pulse; Two-pulse Control
COPYRIGHT: 1975 PLenum Press, REPRINTED WITH PERMISSION
- 1977**
(SWITCHES; OPENING; BREAKDOWN STUDIES)
(Vacuum Gaps; Magnetic Field; Vacuum; Electrical)
STABILITY OF AC VACUUM ARCS IN TRANSVERSE PULSED MAGNETIC FIELD
B. L. Rao, S. Linke and R. M. Sudan
Cornell University, Ithaca, NY 14850
IEEE Trans Plasma Sci., Vol. PS-4, No. 2, pp. 148-152 (06/1976).
The preliminary results of an experimental study of the effect of an external transverse pulsed magnetic field on the stability of AC vacuum arcs are reported. An air-core coil that will produce magnetic fields of up to 4,000 gauss in the arcing region was designed, built, and tested. The magnetic field is initiated a few hundred microseconds prior to current zero. The magnetic field is found to help in the interruption process of the arc and an alternative explanation is offered for the observed phenomena. 10 Refs.
Primary Keywords: Vacuum Arcs; Transverse Pulsed Magnetic Field; Arc Interruption; Erosion
Secondary Keywords: Electron Erosion
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION
- 1978**
(PARTICLE BEAMS, ELECTRON)
(Review)
CIVILIAN APPLICATIONS OF PARTICLE-BEAM-INITIATED INERTIAL CONFINEMENT FUSION TECHNOLOGY
S. G. Varnado, J. L. Mitchiner and G. Yonas
Sandia Labs, Albuquerque, NM 87185
Sandia Report No. SAND77-0516 (05/1977)
Availability: SAND77-0516
NTIS
Electrical power generation by controlled fusion may provide a partial solution to the world's long-term energy supply problem. Achievement of a fusion reaction requires the confinement of an extremely hot plasma for a time long enough to allow fuel burnup. Inertial confinement of the plasma may be possible through the use of tightly focused, relativistic electron or ion beams to compress a fuel pellet. The Sandia Particle Beam Fusion program is developing the particle-beam accelerators necessary to achieve fuel ignition. In this report we review the status of the particle-beam fusion technology development program and identify several potential civilian applications for this technology. We describe the program objectives, discuss the specific accelerators presently under development, and briefly review the results of beam-focusing and target-irradiation experiments. Then we identify and discuss applications for the beam technology and for the fusion neutrons. The applications are grouped into near-term, intermediate-term, and long-term categories. Near-term applications for the beam technology include electron-beam pumping of gas lasers and several commercial applications. Intermediate-term applications (pellet gain > 50) include hybrid reactors for electrical power production, and medical therapy using ion accelerators. In the long term, complex, high-gain pellets may be used in pure fusion reactors. 66 Refs.
Primary Keywords: Relativistic E-Beam; Light Ion Beam; Beam Focusing; Water-Dielectric
Secondary Keywords: Inertial Confinement Fusion; Gas Laser Excitation; ICF Targets
- 1982**
DESIGN OF A HIGH-VOLTAGE GENERATOR FOR THE LASL IMPLOSION-HEATING EXPERIMENT
J. E. Hammel, I. Henning, J. Marshall and A. R. Sherwood
Los Alamos National Lab., Los Alamos, NM 87544
No. CONF-31114-37-4c (01/1975)
Availability: LASL JR-73-172
NTIS
For abstract, see NSA 29 3d, number 16439.
Primary Keywords: Toroidal Theta Pinch Devices; Plasma Heating; Pulse Generators; Specifications; Compression; Implosions
Secondary Keywords: AEC
- 1990**
(REVIEWS AND CONFERENCES; ENERGY STORAGE; PULSE GENERATORS; SWITCHES)
(Reviews; Reviews; Reviews; Reviews)
GENERATION OF ULTRA-HIGH POWER ELECTRICAL PULSES
L. Birnbaum and E. Levi
Polytechnic Institute of New York, Brooklyn, NY 11201
RADC Report No. RADC-TR-74-119 (05/1974).
Availability: AD 78114
NTIS
This report is a comprehensive assessment of the state-of-the-art of various energy conversion techniques involving high power electrical pulse generation. The subjects treated include rotating machines, explosive devices, superconductivity, switching, and plasma techniques, including the supercritical temperature and pressure regions. 131 Refs.
Primary Keywords: Superconducting Compounds; Electromagnetic Radiation; Electrical Machinery; Electrical Power Conversion Device; Pulse Generator; Energy Storage; Switch; Flux Compression; Capacitor; Inductor
Secondary Keywords: Microwave Generation; RF Transmitter; Nuclear Power Source
- 1991**
(PULSE GENERATORS)
(Marx)
GENERATORS PRODUCING VOLTAGE FOR A TRANSVERSE DISCHARGE
V. H. Ishchenko, V. N. Litvinov and V. N. Starodubskii
Institute Of Semiconductor Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 3, pp 747-749 (04/1974).
Trans. from: Priobry i Tekhnika Eksperimenta 3, 138-140 (May-June 1974).
A series of pulsed voltage generators has been developed operating at voltages of 10 to 70 KV and an energy of 1 to 10 J which are based on an inductance K_{15-10} capacitors and gas-filled spark gaps. The construction of the pulsed voltage generators ensures a rate of current growth in a low-resistance load amounting to approximately 1E13 A/sec and a repetition frequency of up to approximately 1E2 Hz. 5 Refs.
Primary Keywords: Pulse Generator; Modular Construction; Marx Generator; Spark Gap; Repetition; Low Energy
COPYRIGHT: 1974 PLenum Press, REPRINTED WITH PERMISSION
- 2002**
(SWITCHES; CLOSING)
(Gas Gaps; Optical)
STARTING HIGH-VOLTAGE GENERATORS AT A VOLTAGE OF UP TO 1 MV BY MEANS OF PULSED X-RADIATION
V. A. Davidenko, B. A. Dolgoshain, A. N. Lebedev, S. V. Somov and V. M. Starodubtsev
Moscow Engineering-Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, No. 3 pp 753-755 (05/1974).
Trans. from: Priobry i Tekhnika Eksperimenta 3, 113-115 (May-June 1974).
The possibility was investigated of firing a high-voltage spark gap by means of x radiation. It was shown that such firing may be accomplished at voltages of up to 500 KV. The dependence of the efficiency of x-ray firing on the interelectrode distance of the spark gap and a rise time of the voltage across it was studied. A circuit was proposed for using such a spark gap in voltage generators rated up to 1 MV. 7 Refs.
Primary Keywords: Spark Gap; X-ray Triggering; Parameter Study; Interelectrode Distance; Voltage Rise Time
COPYRIGHT: 1974 PLenum Publishing Corp., REPRINTED WITH PERMISSION
- 2003**
(PULSE GENERATORS)
(Miscellaneous)
SUBNANOSECOND RISE TIME PULSES FROM INJECTION LASERS
J. Vanderwall, W. Hattery and Z. Sztekanay
Harry Diamond Labs, Washington, DC 20438
IEEE Journal of Quantum Electronics, (July 1974), pp 570-572 (07/1974).
The hybrid integration of an injection laser with a simple avalanche transistor modulator is shown to produce optical peak powers of several tens of watts, Macitude and pulse rise times appreciably shorter than 1 ns. In certain circumstances the pulse edge assumes the form of a spike having a dispensed rise time of 1.0 ps. 11 Refs.
Primary Keywords: Avalanche Transistor Modulator; Motorola 2N3507
COPYRIGHT: 1974 IEEE. REPRINTED WITH PERMISSION
- 2007**
(BREAKDOWN STUDIES)
(Gas; Electrical)
TUBULAR PULSE-DISCHARGE LAMPS AS CIRCUIT ELEMENTS
V. A. Nam'yan, E. G. Gracheva, V. I. Irtyugov, V. Kalinin and V. Sergeev
Affiliation Not Given
Soviet Journal of Quantum Electronics, Vol. 4, No. 5, pp 656-657 (11/1974).
Trans. from: Kvantovaya Elektronika, Vol. 1, pp 1195-1200.
The results are given of an experimental investigation of the load characteristics of pulsed-discharge xenon lamps with a luminous channel of 16 mm diameter. A description is given of the method of calculating the operating conditions of such lamps in a CLR series circuit. 9 Refs.
Primary Keywords: Tubular Xenon Flashlamps; 16mm Diameter; CLR Series Circuit; Pulse Discharge Length; Reflection Effects
COPYRIGHT: 1974 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 2008**
(PULSE GENERATORS)
(Gas Type)
100 KV RECTANGULAR PULSE GENERATOR WITH NANOSECOND RISETIME
R. D. Compton and J. C. Blackburn
Harry Diamond Lab., Washington, DC 20438
Review Of Scientific Instruments, Vol. 45, No. 12, pp 1546-1549 (12/1974).
A system is described for producing rectangular pulses up to 300 KV in amplitude with rise times of about 1 nsec and pulse widths adjustable between 5 and 20 nsec. A coaxial line is pulse charged from a linear type autotransformer and then discharged by a fast-rise high pressure switch into a matched CuSO₄ sub 1 ohm resistor. A 100 microampere sensitive voltage divider allows monitoring of the pulse rise. The pulse reproducibility is excellent and the low jitter (250 psec) in the discharge switch allows synchronization with other events. The system has been in use for two years with satisfactory results. 1 Refs.
Primary Keywords: 100 KV Rectangular Pulse; Inc. Riserime (98 Ohm Load); 5ns to 20ns Pulse Width; Coaxial; Charge Line; Pulse Charger; Martin-type Autotransformer
COPYRIGHT: 1974 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2013
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ELECTRICAL BREAKDOWN IN A COLD CATHODE VACUUM DIODE
D. Milton, Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Electrical Insulation, Vol. EI-9, No. 2, pp 68-80 (06/1974).
A 50-ns pulse generator is used to obtain time-correlated current-voltage relationships in the prebreakdown region for a long vacuum gap with cold planar elec. trades. Analysis of data indicates several sequential stages occur. These stages include an initial quiet stage of voltage increase without interelectrode current, a microdischarge stage, a field emission stage, a space-charge controlled stage, and a final low-impedance stage where the current becomes sustaining. Electrical breakdown of the gap is considered in terms of a positive ion front moving from the anode. 37 Refs.
Primary Keywords: Variable Breakdown Stages; Microdischarges; Monotonic Current; Field Emission; Sustaining Current; Electrical Breakdown
COPYRIGHT: 1974 IEEE. REPRINTED WITH PERMISSION

2018
(PULSE GENERATORS)
(Trigger)
GENERATOR PRODUCING TRAINS OF HIGH-VOLTAGE PULSES IN THE NANOSECOND RANGE
I.Va. Timoshin (1) and E.I. Kolobarev (1)
(1) Institute Of Nuclear Physics, Academy Of Sciences Of The USSR,
Novosibirsk, USSR. USSR Instruments And Experimental Techniques, Vol. 17, No. 1, pp 107-109 (02/1974).
Trans. From: Priboy i Tekhnika Eksperimenta 1, 101-103 (January-February 1974).
A generator is described which produces rectangular pulses having a length of approx. merely 10 nsec and an amplitude of up to 4 kV across a 75-ohm load, a repetition frequency of approximately 10 MHz with in the pulse train, and a length of the pulse train approximately 100 microseconds with a train repetition frequency of 1 to 5 Hz. 3 Refs.
Primary Keywords: Pulse Generator; kV Output; Repetition; Burst Mode; 10 MHz Repetition Rate; 100 Microsecond Burst; Ferrite Peaking Lines; Thyatron
COPYRIGHT: 1974 PLENUM PRESS. REPRINTED WITH PERMISSION

2021
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
THE FIELD EMISSION INITIATED VACUUM ARC. I. EXPERIMENTS ON ARC INITIATION
W.P. Dyke, J.K. Trolan, E.E. Martin and J.P. Barbour
Linfield College, McMinnville, OR
Physical Review, Vol. 108, No. 5, pp 1043-1054 (09/1953).
It is known that electrical breakdown between metal electrodes can be initiated by field emission. The present work concerns a further study of that initiation process under conditions of excellent vacuum and a clean cathode surface. As the field current density from the single crystal tungsten emitter is continuously increased, the normal emission is terminated by an explosive vacuum arc. Since this breakdown occurs in less than a microsecond, the experimental observations were obtained by use of pulse electronic techniques. The magnitude of the electric field, current density, and work function at the cathode were simultaneously determined prior to breakdown. From this investigation it has been established that: (1) the vacuum arc was initiated at a critical value of the field current density of the order of 10 amperes/cm²; (2) breakdown was predictable and not random; in fact, no recognizable conditions preceding arc formation have been established; at current densities just below the critical value, an electron emission process was observed, which apparently involved both high electric fields and high temperatures; (3) arc formation did not require cathode bombardment by material from the anode or from residual gases; (4) breakdown was independent of the applied microsecond voltage in the range 5kV-60 kV, provided the critical current density was not exceeded; (5) the current during arc exceed the initiating field current by a factor of at least 100. 30 Refs.
Primary Keywords: Field Emission; Tungsten Cathode; Critical Current Density; High Electric Field; High Temperature; Voltage vs Pulse Duration
COPYRIGHT: 1953 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION

2026
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps; Optic)
MEASUREMENT OF THE ACTUATION TIME OF SPARK GAPS IN A CASCADE PULSE-VOLTAGE GENERATOR
J.R. Pekar
Kharkov Polytechnic Institute
Instruments And Experimental Techniques, No. 1 pp 128-131 (01/1974).
Trans. From: Priboy i Tekhnika Eksperimenta 1, 117-120 (January-February 1974).
The methods and results are described of measuring the actuation time of the spark gaps in a seven-stage high-voltage pulse generator. The results were obtained by photographing using an SFR streak camera. The recorded probability curves which were obtained provide a quantitative estimate of the effect of the mutual illumination between spark gaps on the actuation time. 5 Refs.
Primary Keywords: Spark Gaps; Breakdown Time; Ultraviolet Radiation; Gas Communication; Relation To Overvoltage
COPYRIGHT: 1974 PLENUM PUBLISHING CORP., REPRINTED WITH PERMISSION

2030
(PULSE GENERATORS)
(Capacitive)
PULSE GENERATOR FOR A THIN-ECHO NUCLEAR MAGNETIC RESONANCE RELAXOMETER
V.M. Zaganov, A.M. Zharkov, V.S. Matochkin and M.I. Emel'yanov
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1842-1844 (12/1973).
Trans. From: Priboy i Tekhnika Eksperimenta 6, 192-194 (November-December 1973).
The circuit of a rectangular pulse generator designed for modulation of the spin-echo transmitter of a nuclear magnetic resonance (NMR) relaxometer in measurements of the relaxation times in the laboratory and rotating coordinate systems is described. The use of the generator considerably shortens the process of resetting the equipment for measurements performed in different coordinate systems. 6 Refs.
Primary Keywords: Pulse Generator; Delay Line; Pulse Shaper; Several Outputs
COPYRIGHT: 1974 PLENUM PRESS. REPRINTED WITH PERMISSION

2035
(PULSE GENERATORS)
(Miscellaneous)
SIMPLE INSTRUMENTATION FOR RISE AND DECAY TIME MEASUREMENT OF CATHODOLUMINESCENCE IN AN ELECTRON MICROPROBE
J. Lebedzki, L. White and R. Bialis
Pennsylvania State University, University Park, PA
The Review Of Scientific Instruments, Vol. 45, No. 3, pp 451-452 (03/1974).
A pulsed voltage generator has been built for an electron microscope for measuring rise and decay characteristics of cathodoluminescence from micron size sample areas. The pulsed voltage generator has an advantage in that excessive heating of the sample can be avoided by keeping the electron beam on the sample surface only for the duration necessary to get the full trace. Both the pulsing frequency and the pulse duration are variable continuously. Step wide ranges: 6 Prefs.
Primary Keywords: Electron Microprobe; Cathodoluminescence; Variable Pulse Frequency; Variable Pulse Duration
COPYRIGHT: 1974 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2041
(PULSE GENERATORS)
(Miscellaneous)
Z. Ton
University of Auckland, Auckland, New Zealand
Proceedings Of The IEEE, (November 1973), pp 1659-1660 (11/1973).
A single tunnel diode circuit is descr. bed which can generate narrow current pulses from low-amplitude voltage pulses at instances in time corresponding to either the leading or the trailing edge of the driving pulses. The pulse generator is capable of producing 1-nsec pulses at a rate of about 330 Hz. 2 Refs.
Primary Keywords: Displaced Nonlinear Load Line; Tunnel Diode
COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

2042
(DIAGNOSTICS AND INSTRUMENTATION)
(Phys.)
D. Bradley and G. New
Imperial College, University of London, London, UK
Proceedings Of The IEEE, Vol. 62, No. 3, pp 313-345 (03/1974).
247 Prefs.
Primary Keywords: Ultrashort Light Pulse Measurements; Electron-optical Streak Camera; Two-photon Fluorescence Method; Direct Measurements Of I(t); photodiodes; chirping; pulse compression; dynamic Spectroscopy
COPYRIGHT: 1974 IEEE. REPRINTED WITH PERMISSION

2050
(BREAKDOWN STUDIES)
(Gas, Electrical)
FORMATIVE TIME OF PENNING DISCHARGE
S.T. Ivanov
Sofia University, Bulgaria
International Journal Of Electronics, Vol. 34, No. 6, pp 769-775 (06/1973).
This paper describes an investigation done into the formative time of a Penning discharge and into the effect of the anode, anode voltage, pressure, and magnetic field upon this time. The formative time was found to be on the order of hundreds of microseconds and decreased if any of the three varying parameters was increased. This long formative time (as compared to the formative time of a glow discharge) can be explained in terms of the decrease in the cross-section mobility of the electrons. 5 Refs.
Primary Keywords: Penning Discharge; Control Grid; Quench Pulse; Formative Time; Experiment; Theory
COPYRIGHT: 1973 TAYLOR AND FRANCIS LTD.

2051
(BREAKDOWN STUDIES)
(Gas, Electrical)
GAS BREAKDOWN BY A SHORT LASER PULSE
C.L.M. Ireland and C.G. Morgan
University College of Swansea, Singleton Park, Swansea, Wales
Journal Of Phys. In D. Applied Physics, Vol. 6, No. 6, pp 720-729 (03/1973).
The breakdown of gases by short (typically sub-nanosecond) laser pulses within the two dominant mechanisms governing the plasma growth and multiplication and cascade ionization is treated theoretically. It is shown that two important pressure regimes result: a low pressure regime where the breakdown is governed solely by the multiphoton ionization process, and a high-pressure regime where the expression for the threshold breakdown intensity involves both ionization processes as well as the effect of inelasticity in the gas. The predictions of the theory are compared with published experimental data for ruby and Nd/glass lasers. Good agreement is obtained in the case of ruby radiation, and a possible explanation of deviation from the experimental data obtained using a Nd/sun 3% laser is offered. 17 Refs.
Primary Keywords: Sub-nanosecond Laser Pulse; Multiphoton Plasma Growth; Cascade Ionization; Low Pressure; High Pressure; Nd/laser; Ruby Laser
COPYRIGHT: 1973 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2055
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
S. Verd'it
Massachusetts Institute of Technology, Cambridge, MA
Electronics, Vol. 45, No. 21, pp 119-120 (10/1972).
The resistance and inductance of a capacitor is easily measured using a pulse generator and an oscilloscope. The DC offset of the capacitor voltage response is used to calculate the resistance while the overshoot transient is used to calculate the inductance. 9 Refs.
Primary Keywords: Capacitor Characterization; Dissipation Factor; Inductance Measurement
COPYRIGHT: 1972 McGRAW HILL

2082
(**PULSE GENERATORS; BREAKDOWN STUDIES**)
(**Electrodes; Vacuum, Electrical**)
THE NATURE OF FIELD EMISSION SITES

B. M. Cox
Marshall Engineering Lab, Southampton, UK
Journal of Physics D: Applied Physics, Vol. 8, No. 17, pp 2065-2073
(12/1975).

A probe-hole technique for measuring and mapping electron emission from metal surfaces (e.g. contacts from used vacuum switches) has been developed for use *in situ* in a scanning electron microscope. A single emitting region can be selected and its voltage/current characteristic measured. The exact site of the emission source can be predicted, the occurrence of better than four 10 microns, using an electron beam tracking technique; then this site can be examined with the probe-hole technique. Visual evidence is shown of 'conditioning' an electrode by voltage breakdown. The link between the source of pre-breakdown current and the site of a spark is confirmed in an experiment which demonstrates the accuracy of predicting the position of emission sites. The ambiguity of the Fowler-Hardwick method of analysing voltage/current characteristics is shown by the failure to correlate size predictions with visual observation of certain types of emitter. 20 Refs.

Primary Keywords: Field Emission; Scanning Electron Microscope; Emission Site Location; Emission Site Prediction; Electrode Conditioning

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2085
(**ENERGY STORAGE, MECHANICAL**)

THE TESTS OF SLIDING ELECTRICAL CONTACTS FOR HOMOPOLAR GENERATORS
M. Brennenkamp, Z. Eliezer, W.F. Waldon, H.G. Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
IEEE Transactions on Components, Hybrids, and Manufacturing Technology,
Vol. CHMT-2, No. 1, pp 111-115 (03/1979).

Due to the recent interest in homopolar generators as pulsed power supplies, the need has arisen for pulsed brush data on slip rings at high current levels and high surface velocities. Tests were conducted to examine the effect of varying the apparent area of contact on the coefficient of friction, voltage drop, and wear rate. Brush areas from 0.826-3.23 sq.cm. were individually tested at current levels from 0.0-2800 A per brush. Experimental data are presented for a high copper grade of commercially available sintered copper-graphite material. The data corroborate the 'thermal mounding' phenomenon described by R.A. Marshall. 8 Refs.

Primary Keywords: Brush Testing; Pulsed High Current; Variable Brush Area; Voltage Drop Measurement; Wear Rate Measurement

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

2090
(**PULSE GENERATORS**)
(**Capacitive**)

HIGH-VOLTAGE PULSE GENERATOR
L.Z. Barabash, O.I. Kryzhanovskii and P.I. Lebedev
Institute of Theoretical and Experimental Physics, Moscow, USSR
Instruments and Experimental Techniques, No. 1, pp 133-134 (02/1970).
Trans. From: *Fizika i Tekhnika Ekspеримента*, 1, 121-123
(January/February 1970).

A generator of high-voltage pulses for feeding the inflector of an input system injecting an ion beam into the chamber of the JTFP proton synchrotron is described. The generator forms symmetrical different polarity pulses the amplitude of which is adjusted from 10-5 to 10-25 kV; the time of establishing the voltage on the inflector is 150 microseconds, and the interruption time is <0.1 microsecond. 3 Refs.

Primary Keywords: Pulse Generator; Thyristor; Capacitive Load; 25 kV Output; Bipolar Pulse; Symmetric Pulse

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

2094
(**PULSE GENERATORS**)
(**Capacitive**)

NANOSECOND-PULSE GENERATOR USING THYRISTORS

I.I. Rozhkov
Gorki Polytechnic Institute, USSR
Instruments and Experimental Techniques, Vol. 14, No. 4, pp 1083-1084
(08/1971).
Trans. From: *Fizika i Tekhnika Ekspеримента*, 4, 119-120 (July-August 1971).

The paper describes a thyristor circuit for matching the channel in a nanosecond-pulse generator for waves reflected from an unheated load. The shaping of the pulses of the generator is based on using electromagnetic shock waves in transmission lines containing ferrite experimental samples of a nanosecond-pulse generator having a rated power of 3E3 W with a repetition frequency of up to 10 kHz were created. 4 Refs.

Primary Keywords: Pulse Generator; Electromagnetic Shock Wave; Ferrite Loaded Resistor Line; Unheated Storage Capacitor; Non-Reflections; Thyristor; Inverter

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

2100
(**PULSE GENERATORS; PULSE GENERATORS**)

(**Systems; Capacitive**)

PULSED SUPPLY OF PHOTOMULTIPLIERS

I.V. Sanin, N.G. Ivchenko, G.N. Markov and S.V. Smirnov
Instruments and Experimental Techniques, No. 1, pp 185-187 (02/1970).
Trans. From: *Fizika i Tekhnika Ekspеримента*, 1, 163-164
(January/February 1970).

The operation of an FEU-30 photomultiplier on feeding with a pulsed voltage of up to 15 kV and a pulse length of 3 microseconds was studied. The leading edge of a single electron pulse was shaped to 1.5 nsec. The circuit of the pulse generator and effects accompanying the pulsed feeding of the photomultiplier are considered. 5 Refs.

Primary Keywords: Pulse Generator; Thyristor; 10 kV Output; 10 A Output; 3 Microsecond Pulse Width

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

2107
(**PULSE GENERATORS; PULSE GENERATORS**)

(**Systems; Capacitive**)
SPARK-CHAMBER POWER-SUPPLY CIRCUIT WITH SEMICONDUCTOR TRIGGER
A.F. Ilyudin, A.V. Kurochkin, E.M. Shermanzon and Yu.T. Yurkin
Moscow Engineering Physics Institute, Moscow, USSR
Instruments and Experimental Techniques, No. 4, pp 1058-1059 (08/1970).
Trans. From: *Fizika i Tekhnika Ekspеримента*, 4, 90-91 (July-August 1970).

The circuit of a spark-chamber power supply which utilizes transistors operating in the avalanche mode, dynistors, and a vacuum spark relay is presented. The operational threshold is less than 100 mV. The delay of the high voltage pulse with respect to the input pulse is approximately 80 nsec. 2 Refs.

Primary Keywords: Pulse Generator; Transistor Driver Circuit; Vacuum Spark Relay; Low Delay; Low Jitter; Low Trigger Voltage

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

2109
(**PULSE GENERATORS; SWITCHES, CLOSING**)

(**Trigger; Thyristors**)
THYRISTOR HIGH-VOLTAGE PULSE GENERATORS
V.A. Astan'ev, N.S. Voronova and V.M. Khavrov
Instruments and Experimental Techniques, No. 3, pp 817-818 (04/1970).
Trans. From: *Fizika i Tekhnika Ekspеримента*, 3, 162-163 (May-June 1970).
Thyristor high-voltage pulse generators for triggering spark chambers are described. The generators have Au2021 thyristors and produce isolated pulses having for the respective generators the following parameters: pulse voltage, 1.5 and 5 kV; pulse current, 100 and 30 A; rise time 10 nsec, and fall time 30 nsec. 3 Refs.

Primary Keywords: Thyristor Pulse Generators; Thyristor; Pulse Transformer; Cascade Generator

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

2110
(**PULSE GENERATORS; BREAKDOWN STUDIES**)

(**Capacitive; Exploding Wires**)
THYRISTOR PULSE CIRCUIT FOR CONTROLLING THE EXPLOSION OF A THIN WIRE
Ya.S. Brovman and F.I. Slezhinger
Transcaucasian Scientific Center for Experimental Physics, No. 1, pp 139-140 (02/1970).
Trans. From: *Fizika i Tekhnika Ekspеримента*, 1, 126-127
(January/February 1970).

A circuit for control of wire explosion in a magnetic field is described. The wire itself closes the circuit, being driven by a current pulse shaped by an LC circuit containing the wire. 2 Refs.

Primary Keywords: Pulse Generator; Low Voltage; Low Current; Thyristor; Exploding Wire; Self-switching; Wire Displacement; 1 x 5 Force

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

2111
(**BREAKDOWN STUDIES**)

(**Vacuum, Electrical**)
TIME CHARACTERISTICS OF ELECTRICAL BREAKDOWN IN VACUUM
M.F. Olenikova and M.A. Sal'man
Soviet Physics-Technical Physics, Vol. 15, No. 2, pp 242-247 (08/1970).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki*, 40, 333-339 (February 1970).

Volts-second characteristics of breakdown in vacuum up to 550 kV have been determined with interelectrode gaps in the range of 5-15 mm with unconditioned electrodes. The breakdown delay time is calculated from the volt-second characteristics with ramp voltage pulses. It was found that with unconditioned electrodes the pulse factor (surge factor) and delay time increase when the interelectrode gap is increased. 7 Refs.

Primary Keywords: Temporal Resolution; Unconditioned Electrode; 5-15 mm Gap; Delay Measurement

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2133
(**DIAGNOSTICS AND INSTRUMENTATION**)

(**Particle Beams, Neutral**)

SPECTRALLY RESOLVED OPTICAL DIAGNOSTICS FOR HIGH-POWER NEUTRAL BEAMS
J.F. Bonnel, G. Bracco, C. Breton, C. Demichelis, J. Drusius, M. Mattioli, R. O'Donnell and J. Rotteveel
EUROATOM-CEA Centre de Saclay, France, 92260
Physical Letters, Vol. 35A, No. 1, pp 65-68 (12/1979).

An optical method of diagnosing a high-power neutral beam is proposed. Spectral profiles for some of the neutral particle emissions are obtained and then used to calculate the proportions of the different populations. An *a posteriori* check of the results is also done. 7 Refs.

Primary Keywords: Neutral Beam; Target Interactions; Emitted Light; Forward Emission; Beam Energy; Particle Flux

COPYRIGHT: 1979 NORTH HOLLAND PUBLISHING CO.

2139
(**POWER CONDITIONING**)

(**Pulse Transformers**)

DESIGN OF TESLA TRANSFORMERS USED IN DIRECT-VOLTAGE ACCELERATORS
D.K. Gerasimov
University of Sofia, Bulgaria

Soviet Atomic Energy, Vol. 46, No. 3, pp 208-209 (03/1979).

Trans. From: *Atomnaya Energiya*, 46, 179-180 (March 1979). Direct-voltage charged-particle accelerators, employing the Tesla transformer as a high-voltage generator, have come into wide use in recent years. In such accelerators the load to the secondary transformer circuit is the accelerating tube which accelerates beams with pulse currents ranging from tens to several thousands amperes.

The present paper considers theoretically the effect of this load on the processes in the Tesla transformer and on its parameters. 2 Refs.

Primary Keywords: Tesla Transformer; Analysis; Coupling Coefficients; Load Considerations

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

2147
(SWITCHES; CLOSING; SWITCHES; OPENING)
(Vacuum Gaps; Electrical; Vacuum Gaps; Magnetic Field)
MAGNETICALLY CONTROLLED VACUUM-ARC ON-OFF SWITCH

R. Dethlefsen and J. Mylius
Gould Inc., Colmar, PA 15915
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1491-1496
(10/1979).

A vacuum spark gap is demonstrated which attains high-power switch-off capability by a magnetic control field applied to the anode in a Penning-type discharge geometry. Applying the magnetic field raises the arc voltage and excites oscillations. Circuit interruption results if the arc current is reduced to the current chopping level of the cathode material. Short capacitance raises the interruption ability up to 9 kA when interrupted. Transient recovery voltages ranged up to 20 KV. 10 Refs.

Primary Keywords: Vacuum Arc; Pulsed Magnetic Field; Cathode Current Chopping Level; Penning Discharge

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2156
(POWER CONDITIONING)
(Pulse Forming Networks)

PULSE-FORMING NETWORKS WITH TIME-VARYING OR NONLINEAR RESISTIVE LOADS
R.H. Roark, M.E. Porten, L.B. Masten and T.K. Burkes
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1541-1544
(10/1979).

High-power pulse-forming networks (PFN) have been in use for some time. The networks are usually designed using techniques that assume a desired pulse shape and a constant resistive load. High-power gaseous discharge devices have created a need for high-power pulse generation operating into time-varying resistive loads or nonlinear resistive loads. Although some work has been done in designing a PFN with a time-varying load, little has been done for the nonlinear loads in general. In this paper, a study of the effects of a time-varying or nonlinear load on a PFN is presented using simulation techniques. The resultant output pulse is compared to the desired pulse using different error functions, such as mean-square error and absolute error. The sensitivity of the error function with respect to the parameters of the PFN is determined. A criterion is developed for the adjustment of the parameters of a PFN to provide the best pulse delivered to a time-varying or nonlinear resistive load. The form of the desired pulse, the error function, and the type of resistive load can be varied to obtain a specific adjustment criterion. In one case, applying the technique to a given PFN resulted in a 46.4-percent improvement in mean-square error. 5 Refs.

Primary Keywords: Nonlinear Load; Numerical Calculation; Design Considerations; Comparison With Experiment

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2161
(ENERGY STORAGE; INDUCTIVE; PARTICLE BEAMS; ELECTRON)
(Systems; Generation)

ANALYSIS OF AN INDUCTIVE ENERGY HIGH-PERVEANCE ELECTRON-BEAM GENERATOR
M. Heiner
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1531-1536
(10/1979).

Recently, Slivkov and Dolgachev proposed an interesting type of electron-beam generator, consisting of a high-voltage triode in series with a storage inductor. During the storage time, the triode operates with a depressed collector. At the high-energy current pulse is obtained when the triode is switched from a high-perveance state to a low-perveance one. In this paper, the circuit model for the beam generator was expanded to take into account grid capacitance and beam loss. Computer results based on the new circuit model predict a train of sinusoidal-like pulses in the triode output when the grid is suddenly connected to a portion of the storage inductor. An electron-beam generator, capable of producing a train of megavolt pulses at high currents, is predicted. 4 Refs.

Primary Keywords: Storage Inductor; High Voltage Triode; Low Perveance; Modelling; Numerical Calculation

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2164
(POWER CONDITIONING)
(Pulse Forming Network)

A MODULAR PFN WITH PULSEWIDTH AGILITY
H.J. Blinchikoff and R.A. Gardner
Westinghouse Electric Corp., Baltimore, MD 21203
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1537-1540
(10/1979).

This paper describes the design, analysis, and realization of a lightweight, low-impedance pulse-forming network (PFN) in which identical inductor-capacitor modules can be added or removed to change pulsewidth while maintaining high pulse quality without introducing excessive pulse-to-pulse perturbations. The PFN evolved contains an input module that is optimized for a pulse-limited ripple of $\pm 0.5\%$. The ripple remains within the limit as modules are added or removed from the PFN to change the pulsewidth in 2-microsecond steps. The optimum parameters are presented in normalized form, allowing the optimum response to be achieved for arbitrary pulsewidths and network impedances. This low-ripple response is achieved without incorporating mutual inductance into the design; therefore, easing the module turning and assembly. Mutual inductance has been considered indispensable in PFN's, but it is a roadblock for modular construction. Its elimination as a design parameter is the key to realizing the modular PFN. A breadboard was built and tested under high power. Included are measured responses that verify that the modular concept and optimum response can be realized in practice. 2 Refs.

Primary Keywords: Variable Pulse Width; High Pulse Quality; Low Impedance; Modular Design

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2165
(ENERGY CONVERSION; ELECTRICAL; ENERGY CONVERSION, ELECTRICAL)
(Power Supplies; Charging Circuits)

A NEW RESONANCE TRANSFORMER
J.L. Harrison
Maxwell Labs Inc., San Diego, CA 92123
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1545-1549
(10/1979).

Resonance systems have been used to provide transformer-like voltage stepup from a low voltage to a high voltage. However, all series systems have the disadvantage that the voltage gain is limited to $\sqrt{2}$ or less than the ideal value (including the load). This imposes a severe power limit and leads to high line voltage regulation under changing load conditions when the gain is moderate. The circuit described here is a new circuit which overcomes most of these early problems. It provides a gain which is relatively insensitive to the load circuit and is mainly limited to the product of the Q of the resonant loops (i.e., the regulation of the circuit is similar to that of an iron-core transformer). Furthermore, several stages can be in series connected to provide an unlimited potential gain. The circuit is thus a competitor of the iron-core transformer, and will be particularly attractive in very-high-voltage or high-frequency circuits where adequate insulation or hysteresis loss becomes a problem. 1 Refs.

Primary Keywords: Resonance Transformer; Good Voltage Regulation; Resonant Q; High Gain; Series parallel Connection

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2169
(POWER CONDITIONING)

(Pulse Transformers)

DESIGN OF COAXIAL-CABLE PULSE TRANSFORMERS
R.E. Dollinger (1), D.A. Moll (1) and D.L. Smith (2)
(1) State University of New York at Buffalo, Buffalo, NY 14226
(2) AFRL, Kirtland AFB, NM 87117
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1549-1551
(10/1979).

Coaxial-cable pulse transformers with good high-frequency response ($<30\%$ rise time) and excellent high-voltage interwinding insulation (>300 KV primary to secondary) were designed, built, and tested. They have the advantage that the open-circuit transformation ratio is unaffected by the thickness of the interwinding insulation, and good coupling is maintained with step-up designs. An equivalent circuit was developed, involving two coupling coefficients, which predicted the measured results with reasonable accuracy. Values of primary, secondary, and leakage inductances were 1.4, 2.2, and 0.8 microhenry, respectively. 9 Refs.

Primary Keywords: Coaxial-cable Pulse Transformer; Fast Rise Time; High-voltage Capability; Very Good Coupling; Voltage Stages

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2172
(SWITCHES; CLOSING)

(Thyristors)

DOUBLE-ENDED HYDROGEN THYRATRONS FOR CROWBAR PROTECTION OF HIGH-POWER TWT SYSTEMS
N.S. Nicholls (1), H. Menown (2) and R.J. Wheldon (2)
(1) Royal Radar Establishment, Malvern, Worcestershire, UK
(2) English Electric Valve Co Ltd, Chelmsford, Essex, UK
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1456-1461
(10/1979).

The paper describes a new range of compact double-ended thyatrons specifically designed for crowbar use up to 100 kA with an auxiliary power consumption of only 15 W. A detailed test equipment is described which demonstrates the tube's capability of discharging 0.5 microfarad charged to 60 KV, the current rising to 500 A at a rate of 50 KA/microsecond, with an anode delay time of 200 ns. The test equipment simulates either grounded cathode or floating deck operation under conditions where a flash arc fault occurs. The efficiency of the protection is evaluated by monitoring the 'let-through' current, charge, and energy. Coincidence counters register faulty operations. A compact auxiliary supply module makes these tubes especially attractive to aerospace systems engineers. 4 Refs.

Primary Keywords: Ceramic Thyatrons; Multigap; Crowbar; Thyatron

Mode; H₁; Transient Analysis; Fault Simulation

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2175
(SWITCHES; CLOSING)

(Gas Gaps; Electrical)

HIGH REPETITION RATE BURST-MODE SPARK GAP
A. Jaltong, J.L. Pegnato, R. Hester, A. Chesterman, E.G. Cook, T. Yokota and W. Dexter
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp. 1411-1413
(10/1979).

Results are presented on the design and testing of a pressurized gas diode spark-gap switch capable of high repetition rates in a burst mode of operation. The switch parameters which have been achieved are as follows: 220 KV, 40 pico-seconds, a five pulse burst at 1 kHz, 12 ns rise time, 2-nanometer at a pulsewidth of 50 ns. 1 Refs.

Primary Keywords: Gas Diode; Spark Gap; Burst-Mode; High Reliability

Secondary Keywords: Blumlein

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2176
(PARTICLE BEAMS; ELECTRON; PARTICLE BEAMS; ION)

(Generation; Generation; High-Power Electron and Ion Beam Generation)

J.A. Nation
Cornell University, Ithaca, NY 14850
Particle Accelerators, Vol. 10, pp 1-30 (01/1979).
The author presents a review of high-power electron and ion beam generation. A general overview is given for Marx generators, pulse forming networks, insulators (including a presentation of some unpublished data on dielectric strengths and breakdown times), and beam diodes. The mechanisms involved in the generation of electron and ion beams are examined. Also presented are discussions on inductive accelerators and collective ion acceleration. 156 Refs.
Primary Keywords: Review; Beam Description; Machine Description; Basic Physics Of Generation; Marx Generator

COPYRIGHT: 1979 GORDON AND BREACH, SCIENCE PUBLISHERS, INC.

2178

(SWITCHES, CLOSING)
(Gas Gaps, Electrical)MULTICHANNEL SURFACE SPARK GAPS
W.J. Sergeant, R.S. Taylor, A.J. Alcock and K.E. Leopold
National Research Council, Ottawa, Ontario, Canada
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1414-1417
(10/1979)

A study has been undertaken on high-pressure surface discharge switches potentially capable of moderate repetition rate operation. The parametric experiments reported were carried out utilizing the gaps as transfer switches, under pulse charging conditions, between several types of low-impedance transmission lines and a high-pressure rare-gas halide laser discharge, acting as the load. The effects of spark gap internal geometry, gas composition, and controlled changes in the laser load, upon gap multichanneling, closure simultaneity, and peak holdoff capability are discussed. These surface gaps, of length 66 cm, reliably close 19 channels per side (29 per meter) with a holdoff voltage greater than 120 kV and a closure simultaneity of approximately 2 ns for the first 500 shots, increasing to about 5 ns and remaining there for 10000 shots, the test limit to date. Preliminary results at higher charging voltages have yielded intense multichanneling with holdoff voltages in excess of 210 kV. 8 Refs.

Primary Keywords: Surface Discharge; Repetition; Geometric Effects; Internal Multichanneling

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2180

(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)OPERATING CHARACTERISTICS OF THE CROSSED-FIELD CLOSING SWITCH
R.J. Harvey
Hughes Research Labs., Malibu, CA 90265
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1472-1482
(10/1979)

The function of the crossed-field closing switch (CFCS) has been studied over a wide range of variables. Three different modes of conduction have been observed: the conventional crossed-field discharge, a hybrid hollow-cathode discharge, and the vacuum arc. Depending on the amplitude and duration of the current, conduction may typically pass through these modes in the above sequence. The CFCS may be triggered magnetically or by grid control into a number of states with varying levels of voltage drop. Conduction may be allowed in the reverse direction or prevented. The present design is limited in response speed and repetition rate by the inductance of the grid and anode leads, the lack of efficient pressure control, and the need for a pulsed magnetic field. Criteria are presented which show the directions in which extrapolations in design may lead. It is concluded that the CFCS is potentially capable of performing some functions more reliably or effectively than conventional switching devices, and variants of the device may eventually be capable of performing functions not presently achievable by any other means. 13 Refs.

Primary Keywords: Closing Switch; Three Conduction Modes; Magnetic Trigger; Grid Trigger; Helium Filled; Rep-rated

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2186

(SWITCHES, CLOSING)
(Gas Gaps, Self)TIME-RESOLVED RESISTANCE DURING SPARK GAP BREAKDOWN
W.K. Cary Jr. and J.A. Mazzie
Naval Surface Weapons Center, Dahlgren, VA 22468
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1422-1427
(10/1979)

The breakdown voltage and the time derivative of the current through a spark gap terminating a transmission line were measured as a function of 4 gas species, 3 gap pressures, and 4 gap spacings. From these measurements, the time-varying channel resistance, the power, and the energy dissipated in the discharge can be determined for the first 1500 ps of breakdown. Data were obtained with a 74-cm-long transmission line, open at the charging end, and terminated with a spark gap at the other end. The line was pulse charged with a 2-microsecond rise time pulse having a maximum voltage of 3 kV. The breakdown voltage was determined by monitoring the charge voltage waveform while a d/dt probe close to the spark gap provided a sampling oscilloscope with the other desired signal. The latter waveform was then digitized and the data were reconstructed using Fourier techniques on a computer to account for the frequency response of the required signal delay line. 4 Refs.

Primary Keywords: Breakdown Voltage; d/dt Measurement; Derived Resistance; Pulse Forming Line

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2188

(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

DEVELOPMENT OF A 100-KV MULTIMEGAWATT REPETITION RATE GAS SWITCH

A. Romrus
Maxwell Laboratories Inc., San Diego, CA 92123

IEEE Transactions On Electronic Devices, Vol. ED-26, No. 10, pp 1417-1421 (10/1979).

A 100 kV gas switch has been developed and tested which is capable of controlling 5 MW average power when operated up to 250 pps repetition rate. Recovery of the switch voltage holdoff capability after each discharge was accomplished by providing both a 1 ms grace period during which no voltage was applied and by continuously purging the switch with 40 psig pressurized air at flow rates up to 60 SCFM. The switch was tested using a simulation technique in which the switch was subjected to the same repetitive peak voltage and current as it would in controlling several megawatts of average power. Limits of switch performance as a function of air flow rate and peak voltage have been established. 0 Refs.

Primary Keywords: Controls 5 MW Average Power; 250 Pps Repetition Rate; Pressurized Air Flow; Simulation Testing; Matched Load PTF

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2189

(SWITCHES, OPENING)
(Gas, Electrical)

ELECTRICAL BREAKDOWN OF GASES: IONIZATION GROWTH IN AIR AT HIGH PRESSURES

J. Dutton, F.L. Jones and R.W. Palmer
University College of Swansea, Singleton Park, Swansea, Wales
Proc. Phys. Soc., Vol. 78, No. 4, pp. 569-583 (02/1961).

This paper describes experiments used to measure the ionization coefficients in air extending the range of $p\phi$ (pressure x distance) values obtained up to 2500 Torr cm for which the sparking potential is about 80 kV. The growth of E/ϕ for the experiments was varied from 35 to 40 V/cm Torr. The growth of pre-breakdown ionization currents is analyzed using $(I/I_0, d)$ graphs, where I_0 is the small initial current from the cathode. Initial results showed that the cathode surface had an effect on the value of the secondary ionization coefficient. Once these effects were negated by using a silver cathode it was found that the secondary ionization coefficient was dependent only on E/p , while the primary ionization coefficient showed a decrease as pressure was increased at a constant E/p . The results found agree fairly closely with previously published results even though the accuracy of the measurement of the ionization current had improved. 20 Refs.

Primary Keywords: Townsend's Second Ionization Coefficient; E/p Variation; Dry Air

COPYRIGHT: 1961 PHYS. SOC.

2190

(SWITCHES, OPENING)
(Gas, Electrical)

VARIATION OF TOWNSEND'S SECOND COEFFICIENT IN ELECTRODELESS DISCHARGE

S. S. M. and Ghosh A.K.
Jadavpur University, Calcutta, India
Proc. Phys. Soc., Vol. 79 pp 180-189 (06/1962).

The authors report the variation of Townsend's second coefficient in an electrodeless discharge. Results for several lengths and pressures in dry air are presented, along with the variation with E/P . A mathematical expression is presented for the variation of Townsend's second coefficient with E/P , which agrees well with experimental results. 8 Refs.

Primary Keywords: Townsend's Second Coefficient; Electrodeless Discharge; Pressure Variation; E/P Variation

COPYRIGHT: 1962 PHYS. SOC.

2191

(POWER CONDITIONING)
(Pulse Transformers)

PULSE TRANSFORMERS

H.W. Lord
General Electric Co., Schenectady, NY 12301
IEEE Transactions On Magnetics, Vol. MAG-7, No. 1, pp 17-28 (03/1971).

Pulse transformers capable of transmitting substantially rectangular voltage pulses, with durations of less than one microsecond, were developed for radar applications during World War II. Their primary functions were to match the impedances of high-power microwave radio-frequency electron-tube generators to electronic pulse generators and coaxial transmission cables, and to provide polarity reversal and impedance matching functions within pulse generator circuitry. The principle contributor to the development of satisfactory pulse transformers was the development of cores of thin-gauge magnetic materials having 1 microsecond pulse permeabilities in the range of 500 to 3500 for flux-density changes of 10000 G. The development of void free dry-type insulation systems made it possible to produce dry-type pulse transformers for operation at pulse voltages below 12 kV. The pulse transformer development work was paralleled by analytical work which enabled pulse transformer designs to make designs to meet the requirements of the radar equipment designers. This analysis relates the three principal pulse transformer parameters, which are magnetizing inductance, leakage inductance, and effective distributed capacitance, in combination with the circuit parameters which are source resistance, effective load resistance, and load shunt capacitance, to the rise time, top ripple and droop, and fall time of the output pulse. 19 Refs.

Primary Keywords: Impedance Matching; Core Construction; History; Design Considerations

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

2211

(SWITCHES, OPENING)
(Gas Gaps, Crossed-field)

A 100-A 100-KV SF6 HVDC CIRCUIT BREAKER WITH CROSSED-FIELD INTERRUPTERS

G.A. Hoffmann, G.L. Laberge, N.E. Read and L.A. Shilling
Hughes Research Labs., Malibu, CA 90265
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-95, No. 4, pp 1122-1131 (08/1976).

A novel HVDC circuit breaker is described which utilizes crossed-field interrupters in a sequential switching mode. The breaker and its components were tested in an inductive energy storage facility at levels of 1000 A, 100 KV and performed satisfactorily. 22 Refs.

Primary Keywords: 1000 A, 100 KV HVDC Circuit Breaker; Crossed-field Interrupters; Opening Switch

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

2217

(SWITCHES, CLOSING)
(Avalanche Transistors, Electrical)

METHOD OF APPLYING AN AVALANCHE TRANSISTOR GENERATED 70 NS GATING IMPULSE TO A FOCUSED PHOTOMULTIPLIER

B.L. Elphick
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
Journal Of Physics E: Scientific Instruments, Vol. 2, Series 2, pp 953-955 (03/1976).
7 Refs.

Primary Keywords: Transformer Coupled; 70 Nanosecond Pulse Width; 70 Nanosecond Switching Time; Photomultiplier Driver

COPYRIGHT: 1969 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2244

(PULSE GENERATORS; POWER CONDITIONING)
(Systems, Pulse Transformers)

500 KV NANOSECOND SQUARE WAVE PULSE GENERATOR

G.A. Masyats, V.V. Khmyrov and V.P. Osipov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 2, pp 379-381 (04/1969);
Trans. From: Primary i Tekhnika Ekspertiz 2, 102-104 (March-April 1969)

This paper describes a pulse generator with the following output characteristics: pulse amplitude, 50-500 kV; pulse duration, 10-40 nanoseconds; frequency, from single pulses to 50 Hz; pulse front duration, 3 nsec. The generator is designed to feed an electron tube.

Primary Keywords: Marx Generator; Tesla Charging Transformer; Pulse Forming Line; Oil-Core Pulse Transformer
COPYRIGHT: 1969 PLEIUM PRESS. REPRINTED WITH PERMISSION

2266
(PARTICLE BEAMS, ELECTRON)
(Transport)
BEAM CHOPPER FOR SUBNANOSECOND PULSES IN SCANNING ELECTRON MICROSCOPY
H.P. Feuerbaum and J. Otto
Siemens AG, Munchen, FRG
J. Phys. E. Sci. Instrum., Vol. 11 pp. 529-532 (07/1977).
A method for deflecting the beam of primary electrons in a scanning electron microscope is described. Two trough-type travelling-wave structures are driven by two pulse generators of opposite polarity, thus creating the electrostatic field which deflects the beam. Primarily electron beam pulses of 350 ps are realized. 11 Refs.
Primary Keywords: Beam Chopper; Travelling Wave Structure; Fast Rise; Fast Fall
Secondary Keywords: Scanning Electron Microscopy
COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS

2277
(PULSE GENERATORS)
(Trigger)
A HIGH VOLTAGE PULSE GENERATOR FOR ACOUSTOELECTRIC STUDIES
B. Griffing
Purdue University, West Lafayette, IN 47907
The Review Of Scientific Instruments, Vol. 45, No. 7, pp 964-965 (07/1974).
A simple high voltage pulse generator, suitable for acoustoelectric studies, is described. Pulse outputs of variable width and amplitudes up to 1 kV are achieved. A technique to increase the maximum output to 3 kV is mentioned. 2 Refs.
Primary Keywords: Capacitor Energy Store; Thyristor; Rectangular Pulse; 1 kV Operating Voltage
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2281
(BREAKDOWN STUDIES)
(Exploding Wires)
A METHOD FOR DETERMINING DENSITY-RADIUS RELATIONS DURING WIRE EXPLOSIONS
T. Kornreich (1) and H. Chace (2)
(1) Temple University, Philadelphia, PA 19122
(2) Chace Assoc., Punta Gorda, FL 33950
The Review Of Scientific Instruments, Vol. 42, No. 8, pp 1184-1186 (08/1971).
A twin tube flash x-ray unit is used to probe the density of expanding metal vapor produced in exploding wire experiments. Using an axial orientation for one of the tubes, details not seen in usual perpendicular pictures can be brought out. The developed x-ray film is scanned by a microphotometer and the trace compared with a standard wedge exposed on the same film. The tracings are then reduced to obtain density as a function of radius. Typical results as applied to copper wire are included. 4 Refs.
Primary Keywords: Metal Vapor Density; X-ray Diagnostic; Axially Directed Radiation; Copper Wire
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2283
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Gaps, Electrical; Vacuum Gaps, Self)
RELAXATION PULSING WITH A VACUUM ARC DEVICE
A.S. Gilmour Jr., R. Dollinger, C.H. Manikopoulos, F. Schwartz and M. Rosenfeld
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Triannual Modulator Symposium, pp 217-221 (06/1978).
In some configurations of a vacuum arc device with a cylindrical anode and an axially positioned cathode, high-repetition-rate relaxation pulsing occurs. Narrow, repetitive voltage spikes occur with amplitudes well in excess of several kilovolts. Each voltage pulse is accompanied by a rapid 'chop' in the current through the arc from a level as high as 10 kA to zero. The repetition rate for this phenomenon is approximately 30 kHz. Such a repetitive opening switch could be very useful if its pulse characteristics could be controlled. An intensive, experimental and diagnostic effort to understand this phenomenon has been in progress for some time now. This paper will present the results that have been obtained to date concerning the spiking phenomenon. 7 Refs.
Primary Keywords: Switch Spiking; Self Relaxation; Self-magnetic Field; Plasma Burst
COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

2284
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Vacuum Gaps, Electrical; Vacuum, Electrical)
BREAKDOWN MECHANISMS AND ELECTRICAL PROPERTIES OF TRIGGERED VACUUM GAPS
G.R. Govindaraju and F.A. Benson
University of Sheffield, Sheffield, UK
Journal of Applied Physics, Vol. 47, No. 4 pp.1310-1317 (05/1975).
Some electrical characteristics of a triggered vacuum gap (TVG) having three different dielectric materials have been studied. Silicon carbide which possesses very high resistance (10^9 ohms), steatite ceramic of medium resistance (50 ohms) and boron nitride of very low resistance (50 ohms) have been used. The resistance of the dielectric is found to decrease with increasing trigger current and this is attributed to the deposition of metal vapor on the surface. The minimum trigger voltage and trigger current necessary for a successful operation of the TVG are measured. Deconditioning (reduction) in the minimum trigger voltage after repeated firings, has been found and is attributed also to the deposition of metal vapor on the dielectric surface. The minimum trigger current for successful firing of the main gap decreases with increasing trigger voltage. The probability of successful firing of the TVG is found to rise rapidly with increasing trigger voltage. The delay time between the application of the trigger pulse to the breakdown of the main gap decreases with increasing trigger current and trigger voltage. A mechanism is suggested for the operation of the TVG. 13 Refs.
Primary Keywords: Triggered Vacuum Gap; Insulation Effects; Electrode Effects; Resistance Variation; Gen Statistics
COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2303
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A RELIABLE MULTIMEGAVOLT VOLTAGE DIVIDER
D.G. Pajilinan and I. Smith
Physic International Co., San Leandro, CA 94577
The Review Of Scientific Instruments, Vol. 43, No. 2, pp 299-301 (02/1972).
A two stage, DC coupled, linear resistive voltage divider having a rise time of 1.5 nsec has been used to measure voltage pulses up to 1.8 MV on a pulsed electron accelerator. The monitor has proved to be stable, reliable, and has required little maintenance. 5 Refs.
Primary Keywords: Resistive Divider; Two Stage Divider; Copper Sulfate Resistor; 50 Ohm Output
COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2321
(SWITCHES, OPENING; REVIEWS AND CONFERENCES)
(Mechanical: Conferences)
CURRENT INTERRUPTION IN HIGH-VOLTAGE NETWORKS
K. Regalier Ed.
Brown, Boveri & Co Ltd, Baden, Switzerland
Publisher: Plenum Press, New York And London (01/1978).
This conference record is primarily concerned with gas blast interrupters. The interaction of these breakers with the interruption of a power line fault is reported extensively. Two main interruption schemes: the thermal interruption mode and the dielectric interruption mode are studied both theoretically and experimentally. DC current interruption is not considered. 239 Refs.
Primary Keywords: Opening Switch; Gas Blast Interrupter; AC Current Interruption; Thermal Interruption Mode; Dielectric Interruption Mode; Experiment; Theory
COPYRIGHT: 1978 PLENUM PRESS, REPRINTED WITH PERMISSION

2350
(INSULATION, MATERIAL: POWER TRANSMISSION)
(Solid, Cables)
CORRELATION OF ELECTROCHEMICAL TREEING IN POWER CABLES REMOVED FROM SERVICE AND IN CABLES TESTED IN THE LABORATORY
M.A. Martin Jr. and R.A. Hartlein
Georgia Power Co., Atlanta, GA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-99, No. 4, pp 1597-1605 (08/1980).
Laboratory tests were performed to develop a relationship between treeing in extruded dielectric crosslinked polyethylene power cables removed from field service and cables tested in the Georgia Power Company Research Laboratory. New and used cables were subjected to various tests including accelerated treeing, thermal aging and chemical analyses. Cable integrity was examined by physical and optical examination, dissipation factor measurements, partial discharge measurements and AC high voltage breakdown testing. The information gathered during the project aided in the development of accelerated treeing tests to better evaluate the relative resistance of cables to electrochemical treeing and to determine effective cable life. 11 Refs.
Primary Keywords: Cable Insulation; Crosslinked Polyethylene; Insulation Treeing; Cable Life
COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

2360
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
DESIGN AND STRUCTURE OF AN EXTENDED LIFE HIGH CURRENT SPARKGAP
Affinito, D., E. Bar-Avraham and A. Fisher
Univ of California, Irvine, CA
IEEE Transactions On Plasma Science, Vol. PS-7, No. 3, pp 162-163 (05/1979).
The failure modes of a high-current 100-kA 0.6-C sparkgap were studied. The results of the study were used to design and build a high-reliability, high-current sparkgap(130-kA 0.7-C). The structure of the sparkgap and the results of the testing are described. 7 Refs.
Primary Keywords: Failure Modes; Repetitive Pulse Applications; Electrode Erosion; Field Enhancement; Insulator Tracking; Design
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

2382
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A TECHNIQUE FOR MEASURING NONSQUARE PULSED HIGH VOLTAGES TO $\pm 0.2\%$ ACCURACY
J.W. Holm-Kennedy and T.P.C. Ku
University of California, Los Angeles, CA 90024
The Review Of Scientific Instruments, Vol. 43, No. 1, pp 31-37 (01/1972).
An accurate technique ($\leq \pm 1/4\%$ error) for measuring a wide range of pulsed voltages and currents of large magnitude (kilovolts and amperes) and short duration at either low or high repetition rates is presented. The technique is accurate for both square and nonsquare pulses. The technique is particularly suited for measuring the J-E characteristics (current density-electric field) of semiconductors at high electric fields. The unknown voltages are matched on a CRO to voltage-divided Zener diode limited pulses which are accurately known. The sample circuit and reference pulse circuits are given. The accuracy of the technique is demonstrated over a wide voltage and current range. Operating and construction precautions are listed for the convenience of the reader. 0 Refs.
Primary Keywords: Less Than 1% Error; Various Waveshapes; Comparison To Standard; Reprinted; J-E Characteristic
COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**2384
(PARTICLE BEAMS, ION)**

(Generation)
PRODUCTION OF INTENSE FOCUSED ION BEAMS IN A SPHERICAL MAGNETICALLY INSULATED DIODE
M.A. Greenspan, D.A. Hammer and R.H. Sudan
Cornell University, Ithaca, NY 14850
Journal of Applied Physics, Vol. 50, No. 5, pp 3031-3038 (05/1979).
A magnetically insulated ion diode has been constructed with a spherically focusing geometry. The diode has been operated at voltages of approximately 250 and approximately 500 kV, with impedances adjustable to 1- and 7-10 ohm, respectively. The pulse length was approximately 85 ns. Total ion currents were >30k A diode current. In the high voltage case, a focal current density of 2100 A/sq. cm. was obtained; this is >90 times the anode ion current density. Auxiliary magnetic fields were used to steer the beam. With the beam deflection as calculated for a single proton. The diode design and diagnostic techniques are described, as well as possibilities for improvements suggested by our data. 20 Refs.
Primary Keywords: Ion Diode; Magnetic Insulation; 250 kV Operating Voltage; Diode Diagnostics
COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**2396
(SWITCHES, OPENING)**

(Mechanical)
EFFECT OF MECHANICAL CONTACT FORCE ON WITHSTAND VOLTAGE OF COPPER-BISMUTH AND CuLr VACUUM INTERRUPTERS
D. Lloyd (1) and R. Harman (2)
(1) Marchwood Engineering Lab, Southampton, UK
(2) University of Sheffield, Sheffield, UK
Proceedings Of The IEE, Vol. 22, No. 11, pp 1275-1278 (11/1975).
Experiments are described in which the effect of axial compression of the contacts of two commercial vacuum interrupters is examined. The results show that the first few impressions deepen the contacts, but after that the effect is minimal. Spark conditioning of the electrodes with an alternating voltage results in the breakdown voltage of the vacuum gap to be the same in both AC and DC cases. 9 Refs.
Primary Keywords: Vacuum Interrupters; Dielectric Strength; Surface Condition; DC Voltage; AC Voltage
COPYRIGHT: 1975 INSTITUTE OF ELECTRICAL ENGINEERS

**2397
(PARTICLE BEAMS, ION)**

(Generation)
HIGH VOLTAGE PROTECTION OF HIGH POWER ION SOURCES BY FAST VACUUM TUBE SWITCHES
W. Welkus
Institut für Plasmaphysik, Garching, FRG
Symposium Proceedings Fusion Technology, 9th Symposium pp 821-826 (06/1976).
A method is presented for preventing damage to the high voltage accelerating grids of ion sources during vacuum power switches between the power supply and the injector. These switches can also condition the grids against breakdown automatically triggered from a sparkover, and provide pulses of variable duration. Further application as a voltage regulator or current modulator is explored.
Primary Keywords: Ion Source Arc Protection; High Voltage; Vacuum Tube Protecting Switch
Secondary Keywords: Neutral Beam Injection
COPYRIGHT: 1976 PERGAMON PRESS

**2398
(PARTICLE BEAMS, ION)**

(Target Interactions)
ION BEAM EROSION OF ROUGH GLASS SURFACES
M. Taraszewich
Kollman Instrument Corp., Syosset, NY 11791
Applied Optics, Vol. 9, No. 1, pp. 173-176 (06/1969).
Glass, in the final stage of grinding prior to optical polishing, is irradiated with an argon ion beam at a high angle of incidence. A striated surface is produced as individual surface features are sputtered away at different rates depending on the local angle of incidence. The removal of an isolated asperity and the production of a smooth surface through the use of an ion beam are also discussed. 1 Refs.
Primary Keywords: Ion Beam Erosion; Argon Ion Beam; Sputtering
Secondary Keywords: Surface Polishing; Striated Surface
COPYRIGHT: 1970 OPTICAL SOCIETY OF AMERICA

**2399
(BREAKDOWN STUDIES)**

(Gas, Electrical)
TIME LAGS ASSOCIATED WITH ULTRA-HIGH FREQUENCY GAS BREAKDOWN
W. A. Prouse, J.R. Rowbotham and P. G. Monk
University of Durham, Durham, UK
Proc. Phys. Soc., Vol. 79, pp. 158-170 (02/1961).
This paper deals with the time to breakdown of a gas in a parallel plate gap at 183 MHz. Gap widths ranged from 0.2 cm to 0.5 cm for hydrogen, while the pressure was varied between 1 and 20 torr. Air was tested under approximately the same conditions. Gap widths of 0.2 cm to 0.8 cm were used for neon with pressures up to 161 torr. The time lags measured are broken down into a normal time lag and a statistical lag. There were no lags observed in hydrogen, and in air there was no formative lag. At 400 microsecond statistical lags were found. The formative lag in neon was effected when the gap was irradiated with neon light, but not when the gap was varied, meaning perhaps that metastable atoms affected ionization. Both lags had the same magnitude in neon. 12 Refs.
Primary Keywords: Gas Breakdown; AC Breakdown; Ultra-high Frequency; Time lag; Hydrogen
COPYRIGHT: 1962 PHYS. SOC.

**2407
(PULSE GENERATORS)**

(Flux Compression)
EXPLOSIVE-DRIVEN ENERGY GENERATORS WITH TRANSFORMER COUPLING
F. Merlech
Université Catholique de Louvain, Louvain, Belgium
Journal of Physics E: Scientific Instruments, Vol. 12, No. 5, pp 421-429 (05/1979).
The adaptation of inductive-resistive loads to explosive-driven generators by means of pulse transformers is discussed in practical terms. An analytical procedure for optimising the energy transfer is derived, and conditions are stated under which this is valid. Representative examples of generators, transmission lines and pulse transformers are given, including some experimental results on the performance of a helical/elliptical generator capable of delivering 1 MA into 100 nH. 30 Refs.
Primary Keywords: Pulse Transformers; Energy Transfer Optimisation; Inductive Resistive Loads; Transformer Coupling; Load Matching
COPYRIGHT: 1979 IEE, LONDON, UK. ALL RIGHTS RESERVED. REPRINTED WITH PERMISSION

**2419
(BREAKDOWN STUDIES)**

(Gas, Electrical)
INFLUENCE OF HUMIDITY ON THE SPARKOVER OF ROD-ROD GAPS OF SEVERAL GEOMETRICAL FORMS SUBJECTED TO POSITIVE IMPULSE VOLTAGES OF VARYING WAVESHAPES
T.E. Allibone and H.L. Allen
Leeds University, Leeds, UK
Proceedings of IEE, Vol. 126, No. 5, pp 462-466 (05/1979).
The authors report on an experiment designed to expand standard BS 923:1977 concerning humidity correction. Experiments were performed in which the geometrical shape and spacings of the electrodes and the waveshape of the applied voltage were varied. Self breakdown was observed and found to be at wide variance with the standard in several cases. 12 Refs.
Primary Keywords: Rod-Rod Gap; Atmospheric Air; Lightning; Long Pulse; Horizontally Mounted Gap; Corona Initiation
COPYRIGHT: 1979 IEE

**2433
(BREAKDOWN STUDIES)**

(Vacuum, Electrical)
THE SOURCE OF HIGH-BETA ELECTRON EMISSION SITES ON BROAD-AREA HIGH-VOLTAGE ALLOY ELECTRODES
N.K. Allen (1), R.V. Letham (1) and B.M. Cox (2)
(1) University of Aston, Birmingham, Birmingham B4 7ET, UK
(2) Central Electricity Research Lab, Leatherhead, Surrey, UK
Journal of Physics D: Applied Physics, Vol. 12, pp 969-977 (07/1979).
Two recently developed techniques have been used sequentially in an attempt to determine the nature of high-beta field emission sites on a carbon-alloy alloy broad-area electrode surface. The carbon-coated carbon-alloy alloy was used as an alternative to electron-optical methods for locating and examining the emission sites. A 2% high resolution spectrometer for determining the energy spectra of the electrons field-emitted from the site. Furthermore, following these measurements, the elemental composition of the emission area was determined by electron microprobe x-ray analysis. Observations, which cast further doubt upon the traditional concept of field-enhanced microprojections, indicate that the sites are non-metallic and probably consist of impurities located at cracks or grain boundaries in the surface. Tentative hypotheses are proposed for the emission mechanism and include provision for an unstable situation caused by the effects of adsorbed gas atoms. 12 Refs.
Primary Keywords: Electron Emission; Energy Spectra; Composition Of Emission Area; No Microprojections; Grain Boundary
COPYRIGHT: 1979 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**2436
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)**

(Gas, Electrical; Surface Flashover)
ANALYSIS OF FLASHES ACCOMPANYING DISCHARGES IN AIR AT DIELECTRIC SURFACES
J. S. Brzozko, A. Konarzewski, A. Wojciechowicz, E. Zukowski and J. Grudzinski
Bialystok Univ., Warsaw Univ., Bialystok, Poland
J. Phys. D: Appl. Phys., Vol. 9, pp. 2369-2377 (04/1976).
Experiments were done in which the flashes accompanying discharges at the surface of a dielectric were examined using a linear photomultiplier. The dielectric constant was shown to have an effect on the flash-energy spectra when analyzed with respect to time and the applied electric field. Two different types of discharges were observed: high energy, low intensity sparks, and low-energy, high-intensity sparks. 19 Refs.
Primary Keywords: Discharge; Dielectric Surface; Air Discharge; Flash
COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS

**2437
(SWITCHES, CLOSING; BREAKDOWN STUDIES)**

(Gas Gaps; Electrical; Gas, Electrical)
ARC VOLTAGE OF PULSED HIGH CURRENT SPARK GAPS
T.F. James and J.L. Browning
Culham Lab, Abingdon, Oxfordshire, UK
International Conference On Gas Discharges, London, U.K. pp. 318-322 (09/1970).
Experiments are described in which arc voltage measurements are made in a triggered three-electrode spark gap. A resistor is discharged into an inductive load. The peak current, the pressure and the pulse length are varied, and their effects on the arc voltage are observed. Measurements were taken in both argon and air. A general expression for pulsed arc voltage is derived. 6 Refs.
Primary Keywords: Spark Gaps; High Current; Arc Voltage Measurement; Pressure Variation; Pulse Length Variation
COPYRIGHT: 1970 INSTITUTE OF ELECTRICAL ENGINEERS

**2438
(PARTICLE BEAMS, ION, PARTICLE BEAMS, ELECTRON)**

(Generation; Target Interactions)
COLLECTIVE ACCELERATION WITH INTENSE ELECTRON BEAMS
C.L. Olson
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions on Nuclear Science, Vol. NS-22, No. 3, pp. 962-969 (06/1975).
Collective acceleration methods that employ an intense relativistic electron beam (IREB) are discussed. A brief history and a classification of collective acceleration methods are given. Methods examined include IREB injection into neutral gas; IREB injection into vacuum plasma-filled IREB diodes; and vacuum filled IREB diodes. Accelerating fields of order 166 V/cm have been observed experimentally. The collective acceleration processes for IREB injection into neutral gas and vacuum are discussed. It is noted that the collective acceleration processes for IREB diodes have not been elucidated yet. A summary of present collective ion acceleration research areas that involve IREB's is given. 14 Refs.
Primary Keywords: Electron Acceleration; Ion Acceleration; Collective Acceleration; Intense-Relativistic-Electron-Beam
COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

**2439
(PARTICLE BEAMS, ELECTRON)**

(Review)
COMPACT HIGH VOLTAGE ACCELERATORS OF CHARGED PARTICLES IN SPACE EXPERIMENTS
A.G. Ponomarenko and R.I. Sloboukh
Institute for Pure & Applied Mechanics, Novosibirsk, USSR
Arts International, Vol. 1, pp. 315-330 (03/1974).
The author addresses the problem of the generation of pulse electric fields in the megavolt range using the limited power sources available in a spacecraft. The electron beams produced could then be used to study the earth's radiation belts and magnetic field. Possible methods of developing the IFAE are necessary are discussed. The ion beam accelerated lasers are also discussed. 14 Refs.
Primary Keywords: Particle Beam Generation; Ion Beam Propulsion; Heavy Ion Accelerator; Ion Propulsion; Particle Generation
COPYRIGHT: 1974 IAEA, Vienna, Earth's Magnetic Field
C. E. Light, 1974 EDITION

**2440
(ENERGY STORAGE; INDUCTIVE; SWITCHES, OPENING)**
(Systems; Mechanical)

DEVELOPMENT OF A PULSED HIGH-ENERGY INDUCTIVE ENERGY STORAGE SYSTEM
J. Teno, D.K. Sonju and J.M. Lontz
Avco Everett Research Lab., Inc., Everett, MA 02149
AFAPL Report No. AFAPL-TR-73-49 (08/1973).
Availability: AD-766518

NTIS

This work was concerned with the complete investigation and feasibility demonstration of superconducting inductive energy storage systems capable of producing high power pulses in the 200 microsecond range on a repetitive basis. The system studied was a 100 kJ system. A 15 kJ model system was successfully tested. Also, as part of this program, a complete investigation of switches appropriate for short pulsed inductive energy storage systems was made. This investigation led to the preliminary development of a multiple contact high speed switch which was successfully tested in model size. 4 Refs.

Primary Keywords: Superconducting; Energy Storage; Switching; Inductive Energy Storage Coils; Multiple Contact Switches; High Speed Switches; Pulse-forming Networks; High Power Pulses

Secondary Keywords: Rapidly Changing Currents In A Superconductor; Superconducting Coil Delay Lines

**2441
(ENERGY STORAGE; INDUCTIVE)**
(Systems)

K.H. Schmitte DYNAMIC CONSTRAINTS ON INDUCTIVE ENERGY STORAGE
Institut für Plasmaphysik, Garching, FRG
IEEE Sixth Symposium On Engineering Problems Of Fusion Research pp
736-237 (11/1975).

Relations between energy density and discharge rate in inductive energy storage units are considered. The dynamic constraints imposed on the unit size are estimated for the Brooks coil geometry. 0 Refs.

Primary Keywords: Storage Inductor; Spurious Capacitance; Inductive Load; Brooks Coil

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

**2442
(SWITCHES; CLOSING; BREAKDOWN STUDIES)**
(Vacuum Gaps; Self; Vacuum, Electrical)

EFFECTS OF VOLTAGE POLARITY, ELECTRIC CURRENT, EXTERNAL RESISTANCE, NUMBER OF SPARKINGS, SUPPLY FREQUENCY, AND ADDITION OF HYDROGEN AND AIR ON ELECTRICAL BREAKDOWN IN VACUUM

R. Heckam
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 46, No. 9 pp. 3789-3799 (01/1975).
The breakdown potential of a vacuum gap is measured using parallel planar electrodes made of sterling silver as a function of gap separations, number of sparkings, external resistance, and polarization of hydrogen and air pressures using DC and AC (50 Hz) applied voltages. It is found that the DC and AC vacuum breakdown voltages become equal after full conditioning by repeated sparkings of both electrodes either with AC or with both polarities of the DC applied voltage. The vacuum breakdown voltage is found to be independent of supply frequency up to 250 Hz. The vacuum breakdown voltage decreases with decreasing the external circuit resistance in series with the gap in the range below 1000 ohms. This decrease in the breakdown potential is attributed to the very short discharge time of the stray capacitive energy of the connecting leads into the gap compared to the time necessary for the current growth leading to breakdown. The minimum energy necessary to decondition (degrade) a vacuum gap is measured and the degree of deconditioning is determined as a function of energy discharged into the gap. The DC dielectric strength of the vacuum gap always recovers to its original value after a few sparkings. 50 Refs.

Primary Keywords: Vacuum Gaps; Breakdown Potential; Planar Electrode; Rep Rate; Gap Recovery; Gap Conditioning

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**2443
(PARTICLE BEAMS, ELECTRON)**
(Target Interactions)

INTENSE RELATIVISTIC ELECTRON BEAM INTERACTION WITH A COOL THETA PINCH PLASMA

D.A. Hammer, K.A. Gerber, W.F. Dove, G.C. Goldenbaum, B.G. Logan, K. Papadopoulos and A.W. Ali
Naval Research Lab., Washington, DC 20375
NRL Memorandum Report No. 3439 (01/1977).
Availability: AD-A036308

NTIS

Experimental results are presented for the heating of a 4 m long plasma column by a uniform magnetic field of 4-5 kg by an intense relativistic electron beam. The initial plasma density ranged from approximately 3E13/cu. cm. to approximately 1E15/cu. cm., the lower density cases being partially ionized and the higher density cases highly ionized. In all cases, the energy coupled from the beam to the plasma is greater than can be explained by energy collisions between beam electrons and the plasma particles. Over most of the density range tested, 3E13/cu. cm. to 1.5E15/cu. cm., the plasma heating cannot be explained quantitatively by the use of a full nonlinear treatment of the electron-electron two stream instability in the kinetic regime. A review of beam plasma interaction theory and previous experiments is presented to facilitate comparison with the present results. 6 Refs.

Primary Keywords: Intense Electron Beams; Ionization By Electron Beams

Secondary Keywords: Beam-Plasma Heating

**2444
(BREAKDOWN STUDIES)**
(Reviews)

IONIZATION IN THE FIELD OF A STRONG ELECTROMAGNETIC WAVE
Labedev, P. N.
Physics Institute, Academy of Sciences of the USSR, Leningrad, USSR
Soviet Physics JETP Vol. 20, No. 5 pp 1307-1314 (05/1965).
Trans. From: J. Exptl. Theoret. Phys. (USSR) 47, 1945-1957 (November 1964)

Expressions are obtained for the probability of ionization of atoms and solid bodies in the field of strong electromagnetic wave whose frequency is lower than the ionization potential. In the limiting case of low frequencies these expressions change into the well known formulas for the probability of tunnel auto-ionization; at high frequencies they describe processes in which several photons are absorbed simultaneously. The ionization probability has a number of resonance maxima due to intermediate transition of the atom to an excited state. In the vicinity of such a maximum the ionization cross section increases by several orders of magnitude. The positions and widths of these resonances depend on the field strength and the wave. It is shown that for optical frequencies the mechanism under consideration of direct ionization by the wave field, may be significant in the case of electric breakdown in gases, and especially in condensed media. 8 Refs.

Primary Keywords: Ionization; Multi-photon Absorption; Solids; Gases; Theory; Resonance Effect

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**2446
(PARTICLE BEAMS, ELECTRON)**

(Target Interactions)

MAGNETIC-FIELD-INDUCED ENHANCEMENT OF RELATIVISTIC-ELECTRON-BEAM ENERGY DEPOSITION

D. Mosher and I.B. Bernstein
Naval Research Lab., Washington, DC 20375
NRL Memorandum Report No. 3441 (02/1977).
Availability: AD A037693

NTIS

The collisionless transport of relativistic electron beams in dense, magnetized, high-Z plasmas is characterized by a perturbation solution of the relativistic Boltzmann equation with a Fokker-Planck collision term in the limit of small beam-electron mean-free-path or gyroradius. The general formulation allows for arbitrary magnetic-field, electric-field, and plasma geometries. Analytic solutions in 1-D yield energy-deposition profiles for a magnetized plasma slab. 10 Refs.

Primary Keywords: Relativistic Electron Beams; Energy-deposition Profiles; B-field Enhancement

2448

(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ION)

(Transport; Transport)
RADIANCE AND RADIANT ENERGY DENSITY IN LIGHT OPTICS AND ELECTRON OPTICS ANALOGIES, DIFFERENCES, AND PRACTICAL CONSEQUENCES

B.W. Schumacher
Westinghouse Electric Corp., Pittsburgh PA
Optik, Vol. 45, No. 4 pp. 355-380 (01/1976).

The geometrical-optical description of light is compared to that of corpuscular beams. The differences and similarities in the concepts of radiance, energy flux, spatial energy density, spatial radiation density, and power of a beam as they apply to light optics and electron optics are examined. The analogy showing the refractive index of a medium for a light beam is similar to the beam voltage for an electron beam is used as the basis for the comparison. Special emphasis is placed on the energy carrying and concentration properties of the two types of beams. 16 Refs.

Primary Keywords: Particle Beam Optics; Comparison With Light; Radiance
Secondary Keywords: Optical Ray Tracing

COPYRIGHT: 1975 WISSENSCHAFTLICHE VERLAGSGESELLSCHAFT

2449

(DIAGNOSTICS AND INSTRUMENTATION)

(Reviews)

SENSORS FOR ELECTROMAGNETIC PULSE MEASUREMENTS BOTH INSIDE AND AWAY FROM NUCLEAR SOURCE REGIONS

C. E. Baum (1), E.L. Green (1), J.C. Giles (2), J. O'Neill (1) and G. D. Sauer (2)
(1) AFSC, Kirtland AFB, NM 87117
(2) EG&G, Inc., Albuquerque, NM 87114
IEEE Transactions On Antennas And Propagation, Vol. AP-26, No. 1 pp. 24-35 (01/1978).

For measuring transient electromagnetic fields and related quantities, one needs accurate broadband sensors with simple transfer functions. The various sensor designs developed to achieve this in an optimal manner are summarized. Such sensors are designed for use either in a free space environment (such as in an EMP simulator or in a system under test in such a simulator) or in a nuclear source region that includes local source current and perhaps conductivity. There are now numerous designs which have been iterated for improvements over the last decade. 85 Refs.

Primary Keywords: Sensor; Electromagnetic Pulse; Electromagnetic Field Measurement; Antenna; D-Dot Sensor

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

2450

(SWITCHES; CLOSING; SWITCHES, OPENING)

(Reviews; Relays)

SOME SWITCHING PROBLEMS IN THERMONUCLEAR RESEARCH

D.L. Smart
Atomic Energy Research Establishment, Harwell, Berkshire, UK
IEE Paper No. 2932, pp 107-116 (04/1959).

The problems of switching a large amount of energy from a storage device to an inductive load is examined. Several combinations of spark gap, vacuum arc, and mechanical switches that are possible are discussed along with their limitations. Inductive energy storage requires the use of circuit-breakers with a large breaking capacity; several possible arrangements are looked at. 11 Refs.

Primary Keywords: Spark Gap; Loads; Switching System; Ignitron; Circuit Breaker

Secondary Keywords: Thermonuclear Research

COPYRIGHT: 1959 IEE

2451
(BREAKDOWN STUDIES)
(Reviews)

THE EXCITATION AND IONIZATION OF ATOMS IN A STRONG RADIATION FIELD
F.V. Bunkin and A.M. Prokhorov
P.M. Naukova Physics Institute, Academy of Sciences of the USSR,
Leningrad, USSR

Soviet Physics JETP, Vol. 19, No. 3 pp. 739-743 (09/1964);
Trans. From: J. Exptl. Theoret. Phys. (USSR) 46, 1090-1097 (March 1964)

Some general results are obtained regarding the behavior of atomic systems in a strong radiation field. By the latter is understood a radiation field with such a density that the energy of interaction between it and the atomic electrons approaches that between the electrons and nucleus. It is shown, in particular, that if the interaction time between the atom and field is sufficiently large, atomic ionization will be more probable than its excitation in the bound state, even though the field quantum may be much smaller than the ionization potential. Some estimates of the photoionization potential are presented.

Primary Keywords: Ionization; Strong Radiation Field; Multi-photon Absorption; Effective Ionizing Field

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2455
(PARTICLE BEAMS, ION)
(Generation)

A COMPACT 250-KV INJECTOR SYSTEM FOR PIGMI
R.W. Hrmr, R.R. Stevens Jr., D.W. Mueller, J.N. Leavitt and H.M. Lederer
Los Alamos National Labs, Los Alamos, NM 87545
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 1, pp 1493-1495
10/2/1979

A 250-kV proton injector to be used in the development of a linear suitable for medical applications has been constructed. This injector uses a split magnetic dipole magnet to produce a low-energy beam. A gas insulated accelerating column is contained over a grounded vacuum system, with a separate high voltage equipment dome connected to a 100-kV Cockcroft-Walton power supply. The injector can be operated locally or remotely, with the remote control accomplished by a microprocessor system linked to a central control minicomputer. This injector has been designed as a low-cost compact system. The design details and the data obtained during initial operation are presented. 5 Refs.

Primary Keywords: LINAC; Low Current; Medium Energy; Proton Beam

Secondary Keywords: Medical Application

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

2503
(PARTICLE BEAMS, ELECTRON; ENERGY CONVERSION, ELECTRICAL)

(Generation; Power Supplies)

PROTECTING A HIGH-VOLTAGE ELECTRON GUN POWER SUPPLY FROM BREAKDOWNS
A.G. Klyukinov and V.M. Lebedev
Soviet Journal of Optical Technology, Vol. 45, No. 5, pp 312-314
5/05/1978

Trans. From: Optiko-mekhanicheskaya Promyshlennost 45, 49-51 (May 1978)
Systems for protecting an electron gun from short-term shorts across its high-voltage power supply are examined. Protection systems are discussed for low and high power devices as well as low voltage sputtering devices. Magnetic regulators, limiting resistors, self-excited oscillators, and ageing the electrodes are considered. 0 Refs.

Primary Keywords: Interelectrode Breakdown; Magnetic Regulator; High-frequency Power Supply; Resistive Current Limiting

COPYRIGHT: 1979 THE OPTICAL SOCIETY OF AMERICA

2521
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

AN OPTIMIZED CHARGE SIMULATION METHOD FOR THE CALCULATION OF HIGH VOLTAGE FIELDS
A. Yiallisis, E. Kuffel and P.H. Alexander
University of Windsor, Windsor, Ontario, Canada

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 6, pp 2434-2440 (11/1977).

A new approach for the computation of electric fields is described, based on the application of optimization techniques to the charge simulation method. The charge simulation technique is briefly considered and the optimized version is formulated. The solution of the problem of the electrode configuration is solved as a sample problem for comparative purposes, and consideration is given to the solution of field distributions with non-axial symmetry. The now optimized approach proves to be more efficient, minimizing the time required to set up and implement a solution of this kind. 15 Refs.

Primary Keywords: Electrical Field Calculation; Charge Simulation

Optimization techniques; No Axial Symmetry

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

2525
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

A MULTI-MEGAWATT VACUUM ARC SWITCHED INVERTER FOR AIRBORNE APPLICATIONS
R.H. Miller, D.C. Hopkins, C.J. King, A. Padano, R. Dollinger and A.S. Gilmore Jr.

State University of New York at Buffalo, Buffalo, NY 14226

1978 IEEE Thirteenth Modulator Symposium, pp 204-207 (06/1978).

In previous papers the single-cycle tests of the operation of a vacuum arc switched inverter have been reported. Now, the High Power Test Facility at the State University of New York at Buffalo has reached a sufficient state of completion to permit more advanced testing of the inverter than has previously been reported. Several of these tests have been completed in which many cycles having peak voltage amplitudes up to 1.6 kV and peak current amplitudes up to 1.8 kA were produced. The switches used in this advanced inverter employ several new refinements in the evolution of electrically controlled vacuum arc switches. The inverter employing these new switches is also refined, with special care being taken to reduce internal power losses in the circuit elements and leads. These tests and refinements emphasize the usefulness of vacuum arc switches in high power inverter applications. 6 Refs.

Primary Keywords: Inverter; High Power; High Frequency; Low Loss

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

2529
(BREAKDOWN STUDIES)
(Electrodes)

ANODE CURRENT DENSITY IN HIGH-CURRENT PULSED ARCS

K.T. Shin
General Dynamics Corp, San Diego, CA 92112

Journal Of Applied Physics, Vol. 43, No. 12, pp 5002-5005 (12/1972).

A method has been developed using a split anode to measure the anode current density distribution in high-current pulsed arcs. Rogowski coils were used to detect the current to each half of the split anode as a function of arc position relative to the splitting plane. Transformation equations were derived to obtain local values of current density from the measured lateral distributions. The data were taken using a copper anode in air at one atmosphere with arc current from 750 to 2250 A. The peak anode current densities were found to be between 3.4E5 and 5.5E5 A/cm. 9 Refs.

Primary Keywords: Anode Current Density; Split Anode; Copper Anode; Arc Position; Transformation Equation

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2532
(BREAKDOWN STUDIES)
(Gas, Optical)

CO/SUB 2/ LASER-INDUCED GAS BREAKDOWN IN HYDROGEN

J. Offenberger and H.H. Burnett

University of Alberta, Edmonton, Alberta, Canada

Journal Of Applied Physics, Vol. 43, No. 12, pp 4972-4980 (12/1972). A single-mode CO/sub 2/ laser pulse of approximately 10 MW peak power has been used to induce breakdown at pressures from 50 to 700 Torr in hydrogen. Measurements of the reflected and transmitted laser intensity were obtained and the properties of the resulting spark were studied by means of image converter camera and spectroscopic techniques. At pressures in excess of 100 Torr the spark was observed to grow preferentially towards the focusing lens, while at lower pressures a symmetric expansion was observed. The observed motion was consistent with the existence of a breakdown wave during the rising portion of the laser pulse followed by a laser-supported detonation. At pressures greater than 100 Torr no significant reflection (> 2%) was observed during the detonation phase. 11 Refs.

Primary Keywords: CO/sub 2/ Laser; Hydrogen Gas; Low Pressure; Spectroscopic Spark Diagnostic; Transmitted Radiation; Reflected Radiation

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2537
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

CURRENTS PRECEDING ELECTRICAL BREAKDOWN IN VACUUM

I.M. Slijkov
Soviet Physics-Techical Physics, Vol. 12, No. 11, pp 1482-1486
10/05/1968

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 2015-2020 (November 1967)
The present-day hypotheses about the mechanism of electrical breakdown in vacuum give different degrees of importance to the role played in the initiation of breakdown by currents flowing between the electrodes before breakdown. Thus, when the breakdown is initiated by field emission from projections on the cathode, or by microdischarges (by current pulses of a duration 10^{-5} - 10^{-3} sec), this current is an immediate cause of breakdown. However, no such straight-forward relationship between breakdown and the current flowing before it may exist when the breakdown is initiated by microparticle impact. For this reason, an oscillographic investigation of the prebreakdown current is of particular importance in the case of a slightly nonuniform field between the electrodes when the breakdown mechanism is not entirely clear. This is the object of this article. 7 Refs.

Primary Keywords: Breakdown; Centrifugal Microparticle Impact; Non-uniform Field; Microparticle Impact;

Hemispherical-plane Gap; Hemispherical-plane Gap

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2539
(DIAGNOSTICS AND INSTRUMENTATION)

(Data Transmission)

FAIL-SAFE FIBER-OPTICS DATA BUS USING ACTIVE MULTIMODE MIRROR TERMINALS

W.B. Soillinen Jr., P.L. Gravel and R.A. Soref

Sperry Research Center, Sudbury, MA 01776

Applied Optics, Vol. 17, No. 23, pp 3822-3826 (12/1978).

Low-loss active switching devices are used to construct a fail-safe optical data bus. The system uses only one optical source, and shows low optical loss in the fail-safe mode. The LED sources, PIN photodiode detectors, and the step-under multimode fibers used are all commercially available, and by using a pulse transformer technique the electrooptic modulation voltages needed can be generated from a 5-V supply which makes the system TTL compatible. 10 Refs.

Primary Keywords: Fiber-optic Data Bus; Electrooptic Mirror Terminal; Low Loss; Single-supply Operation

COPYRIGHT: 1978 OPTICAL SOCIETY OF AMERICA

2561

(SWITCHES; CLOSING; SWITCHES, OPENING)

(Vacuum Gaps, Electrical; Vacuum Gaps, Self)

HIGH REPETITION RATE, HIGH POWER PULSE TESTS OF VACUUM ARC SWITCHES

R.H. Miller, R. Dollinger and A.S. Gilmore Jr.

State University of New York at Buffalo, Buffalo, NY 14226

1978 IEEE Thirteenth Modulator Symposium, pp 200-203 (06/1978).

Research has been proceeding at the State University of New York at Buffalo on vacuum arc switches that can be operated in a pulsed mode. These switches have been demonstrated to have turn-on and turn-off times in the order of microseconds, and recent tests now show that the vacuum arc switch exhibits significant potential for high frequency pulsing applications. These new tests, which have been conducted on vacuum arc switches employed in a series inverter circuit to show that the switches can be reliably turned on by kilovolt-level triggers having a rise time on the order of one microsecond, they also show that the switches can be reliably self-commutated to a turn-off mode by the operation of a series resonant circuit placed in series with the load. Combining these two techniques provides reliable pulsing of the vacuum arc switches if the resonant frequency of the resonant circuit is higher than the pulsing rate of the switches. Using this procedure, repetition rates in the five to eight-joule range have been reached. 5 Refs.

Primary Keywords: Self-commutation; Series Resonant Circuit; Penetrating Cathode Igniter

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

2547

(SWITCHES, CLOSING)
(Vacuum Gaps; Electrical)

DELAY CHARACTERISTICS OF VACUUM DISC SWITCHES
 G.M. Aratov, V.I. Vasilev, M.I. Pergament and S.S. Tsarevitinov
Soviet Physics-Technical Physics, Vol. 12, No. 1, pp 90-96 (07/1967).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 37, 131-138 (January 1967).
 In a previous article an examination was made of problems regarding the electric strength of vacuum disc spark gaps. In the present article the results of a study of the controllability of such spark gaps are reported, the investigation being confined to vacuum switches with base pressures of $1E-1$ to $1E-3$ mm Hg in the interelectrode region. 17 Refs.

Primary Keywords: Vacuum Spark Gap; Delay Measurement; Jitter Measurement; Aquadag; Trigger Circuit

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2550

(EXPOXY CONVERSION, ELECTRICAL)
(Power Supplies)

LIGHTWEIGHT POWER CONDITIONING MAGNETICS

J.P. Welsh, R.L. Houmesser and D.L. Lockwood
Thermal Technology Lab., Inc., Buffalo, NY
 1978 IEEE Thirteenth Modulator Symposium, pp 71-74 (06/1978).

Recent requirements for lightweight high power magnetics which have led to increased research and development in this and related areas are explained. Transformers with specific weights in the range of 0.1 to 0.25 lbs/kVA have been developed through the utilization of improved materials, improved magnetic circuit modeling, and the application of advanced heat transfer techniques. These thermal aspects are particularly important to the size and weight reduction of power coils. If each conductor in a magnetic device can be adequately cooled throughout most of its length, then the current density can be increased and the conductor cross sectional area significantly reduced. This, in turn, results in a smaller core window and consequently, a smaller core. 2 Refs.

Primary Keywords: Transformer; Small Size; Light Weight; Better Modeling; Thermal Considerations

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

2553

(DIAGNOSTICS AND INSTRUMENTATION)

(Particle Beams; Neutral)

OPTICAL DIAGNOSTICS ON HIGH-POWER NEUTRAL BEAMS

J.F. Bonnel, C. Bleton, C. Demichele, J. Druaux, M. Mettiali, R. Obregon and J. Reinaud
 EURATOM-CEA, Centre d'Etudes Nucléaires, France 92260

Physics Letters, Vol. 69A, No. 2, pp 116-118 (11/1978).
 A method for measuring the optical emission of a high-energy neutral hydrogen beam is presented. The optical profile thus obtained is found to compare well with the profile obtained by conventional electrical methods. 3 Refs.

Primary Keywords: Spectroscopy; No Doppler Shift

COPYRIGHT: 1978 NORTH-HOLLAND PUBLISHING COMPANY

2556

(BREAKDOWN STUDIES)

(Gas; Electrical)

ELECTRICAL FIELD BREAKDOWN IN SULPHUR HEXAFLUORIDE

D.N. George and P.H. Richards
 Marconi Engineering Lab., Southampton, UK
British Journal of Applied Physics (Journal of Physics D), Ser. 2, Vol. 2, pp 1470-1471 (01/1969).

The breakdown strength of SF₆ for uniform electric fields has been measured over a wide range of nd from 1E20 to 2E23 m⁻²/V (pd values at 0 Deg.C. from 3 to 6000 Torr mm) and compared with the dielectric strength of air under the same conditions. 6 Refs.

Primary Keywords: SF₆; Uniform Field; Large pd Range; Comparison with Air

COPYRIGHT: 1969 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2567

(DIAGNOSTICS AND INSTRUMENTATION)

(Particle Beams; Neutral)

A NEUTRAL-PARTICLE ANALYSER FOR PLASMA DIAGNOSTICS

DDR Summers, R.D. Gill and P.E. Stott
Culham Lab., Abingdon, Oxfordshire, UK
Journal of Physics E: Scientific Instruments, Vol. 11, No. 12, pp 2183-2190 (12/1978).

We describe an instrument which can be used to measure the neutral-particle flux from a plasma over the energy range 200 eV to 30 keV. This wide range makes the device especially useful for plasmas where neutral injection heating may be employed. It has been used for measuring both the ion temperature and the high-energy spectrum due to the injection of high-power neutral beams into the DITE (Divertor Injection Tokamak Experiment) Tokamak. 12 Refs.

Primary Keywords: Neutral-particle Flux; 200eV To 30keV; Neutral Injection Heating; Ion Temperature; Energy Spectrum; Tokamak

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2598

(SWITCHES, CLOSING)

(Vacuum Gaps; Electrical)

ELECTRICAL STRENGTH OF VACUUM DISC SWITCHES

G.M. Aratov, V.I. Vasilev, M.I. Pergament and S.S. Tsarevitinov
Soviet Physics-Technical Physics, Vol. 11, No. 11, pp 1548-1555 (05/1967).

Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 36, 2080-2092 (November 1967).
 A study is made of the electrical strength, response time, inductance, and other characteristics of multiple action vacuum disc spark gaps (having an initial pressure of $1E-3$ to $1E-1$ mm Hg), designed for switching heavy electric currents (up to 2E6 A) at voltages of up to 30 to 50 kV. A description is given of the results of an investigation of the dependence of the electrical strength of the spark gaps on the nature and initial pressure of the gas in the region between the electrodes, on the size of the interelectrode gap, and on the number of partitions, and construction of the metal partitions. Data are presented on the durability of spark gaps of a number of types. 19 Refs.

Primary Keywords: Vacuum Spark Gap; Hold Off Voltage; Delay Variation; Reliability Test

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2621

(INSULATION, MATERIAL; SWITCHES, CLOSING)

(Composite; Molecular Sieve)

A GAS-PHASE HIGH-VOLTAGE ELECTRICAL ISOLATOR WITH CONTROLLED BREAKDOWN

J.W. Pye
Royal Aircraft Establishment, Farnborough, UK
Journal of Physics E: Scientific Instruments, Vol. 11, pp 825-829 (08/1978).

A simple electrical isolation device is described, which incorporates an insulating porous core to assist in electron-ion recombination. Designed for isolating an ion thruster from its mercury propellant feed system, it has resulted in stand-off voltages in excess of 7 kV at normal operating mercury vapour pressures. Breakdown investigations, leading to the final design, have been included and these show that operation as a controlled high-voltage switch is possible. Some of the life-limiting operating factors have been identified. 25 Refs.

Primary Keywords: Insulator; Vapor Pockets; Mercury Vapor; Insulating Bells; Porous Insulator

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2635

(SWITCHES, CLOSING)

(Vacuum Gaps; Materials)

ELECTRODE EROSION IN VACUUM GAP BREAKDOWN BY NANOSECOND PULSES

G.A. Messyats and V.I. Eshkenazi
Soviet Physics Journal, Vol. 11, No. 2, pp 79-82 (02/1968).
 Trans. From: *Izvestiya Vysshikh Uchebnykh Zavedenii: Fizika* 11, 123-125 (1968).

In studies of high-vacuum electrical breakdown much attention has been allotted to electrode erosion. However, only the instant of initiation or the complete breakdown stage have been considered. We studied the erosion on a nanosecond under pulsed breakdown of a 0.35 mm gap at 35 kV for various pulse lengths. 6 Refs.

Primary Keywords: Electrode Erosion; 35 kV Operating Voltage; Variable Pulse Duration

COPYRIGHT: 1968 PLENUM PRESS. REPRINTED WITH PERMISSION

2670

(BREAKDOWN STUDIES)

(Exploding Wires)

ORIGIN OF STRIATIONS DUE TO MECHANICAL EFFECTS IN FAST WIRE EXPLOSIONS

S.H. Smith
Stevens Institute of Technology, Hoboken, NJ 07030
Journal of Applied Physics, Vol. 41, No. 10, pp 3918-3921 (09/1970).

The suggestion that mechanical oscillations in the solid wire are in part responsible for the production of striations observed in a class of wire explosions is investigated using the dispersion relation for elastic waves in isotropic solid cylinders. It is proposed that these oscillations arise due to the transient nature of the electrical energy deposition and that axial waves originate at points of discontinuity such as impurities and grain boundaries. Numerical solutions are obtained using the first shear- and dilatational-mode cutoff frequencies, and the wave numbers of these end standing waves are presented as a function of Poisson's ratio. Experimental data on the average distance between striations and new data are found to lie within the range predicted by the theoretical analysis. 11 Refs.

Primary Keywords: Exploding Wire; Striation; Mechanical Oscillation; Dispersion Relation; Elastic Wave; Theory; Numerical Calculation

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2692

(BREAKDOWN STUDIES)

(Gas; Electrical)

PROCESSES INVOLVED IN THE TRIGGERING OF VACUUM BREAKDOWN BY LOW-VELOCITY MICROPARTICLES

P.A. Chatterton, M.M. Menon and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
Journal of Applied Physics, Vol. 43, No. 11, pp 4536-4542 (11/1972).

The role of low-velocity microparticles (diameters < 100 micron; velocities approximately 10-50 m/sec) in inducing breakdown in a high vacuum gap is investigated. On the basis of a simple model, it is shown that as an anode-initiated microparticle approaches the cathode field, it creates sufficient space charge to cause breakdown (> 1E9 V/m) to be possible at the cathode surface. The emission current not only causes particle neutralization of the initial charge on the microparticle, but also raises the temperature (> 2000 K) of the particle surface. As a consequence, a significant increase in gas pressure (approximately 100 torr) in the microvolume between the cathode and the particle is possible, resulting in a discharge between the two. Such a discharge could act as a trigger for the breakdown of the main gap. Other possible processes that could arise due to the onset of melting or boiling of the bombarded surface, and which may lead to breakdown of the entire gap, are also discussed. 29 Refs.

Primary Keywords: Microparticle; 10-50 m/sec Velocity; 100 Micron Diameter; Vacuum Gap; Gas Liberation

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2717

(BREAKDOWN STUDIES)

(Gas; Electrical)

PULSED BREAKDOWN OF AIR IN A HOMOGENEOUS FIELD AT LARGE OVERVOLTAGES

V.V. Vorob'ev and A.M. Iskol'dskii
Soviet Physics-Technical Physics, Vol. 11, No. 11, pp 1560-1562 (05/1967).

Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 36, 2095-2098 (November 1966).

We have carried out an investigation of the mechanism of electron breakdown in atmospheric air at pressures p=6 to 760 mm Hg with electrode separations d=2 to 5 mm using electron-optical and oscilloscopic methods. Breakdown was initiated in a dark gap located either at the end of or at an air gap situated in a coaxial line with a characteristic impedance of 0.75 ohm. The gap was fed with rectangular voltage pulses of duration τ /sub p/330 nsec (the rise time t was 4% of the leading edge was approximately 1 nsec) and amplitude U₀/sub p/20 to 50 kV; the pulses were formed by a high voltage line generator. 4 Refs.

Primary Keywords: Uniform Field; Impulse Breakdown; High Overvoltage; Air Gas; Variable Pressure; Variable Gap Spacing

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2718
(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

CIRCUIT AND MAGNETIC ANALYSIS FOR A SYSTEM OF FARADAY ROTATOR COILS DRIVEN BY A TWO-SPool, FOUR-ROTOR HOMOPOLAR GENERATOR
D.J. Mayhall (1), W.F. Weldon (1), H.H. Woodson (1), K.M. Tolk (2) and
H.G. Rylander (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
(01/1977)

Availability: CONF-771029-119

NTIS

As part of a cost optimization study, a computer based circuit analysis is performed to determine the energy storage requirements a homopolar generator must meet to drive an inductive load of Faraday rotator coils, which is an option considered for the Lawrence Livermore Laboratory (LLL) Shiva laser system upgrade. The reference load consists of five parallel sets of three different size solenoidal coils in series. Each coil is modelled as a series inductance and resistance. The homopolar is modelled as a capacitance in series with a resistance and an inductance. The transmission lines connecting the homopolar and the coils are modelled as series inductances and resistances. The initial homopolar voltages and energies to create the required coil magnetic fields are obtained versus the small coil turns, homopolar inductance, line length, as are the times to current maximum, peak homopolar currents and peak coil currents. For 50 ft lines, the minimum initial homopolar voltage varies from 20 to 17 MJ. The axial magnetic field variation in the rotator glass is <1.0%. The stored energy for the thickest coils is 2.4 times that of the thinnest coils. (ERA citation 03-025500)

Primary Keywords: Electric Generators; Tokamak Type Reactors; Cost; Electronic Circuits; Energy Storage; Optimization; Specifications

Secondary Keywords: ERDA/700203; DC Generators; Computer Applications; Cost Engineering; NTISDE

2724
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

DEVELOPMENT OF THE SWITCHING COMPONENTS FOR ZT-40
J.G. Melton, R.S. Dike, K.W. Banks and W.C. Nunnelly
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-771029-23, 4p 701/1977.

Availability: LA-UR-77-2440

NTIS

Switching of the main capacitor banks for ZT-40 will be accomplished by spark gap switches. Initially, there will be 576 start switches and 288 crowbar switches. A development program is under way to develop three switches: (1) a versatile start switch, which can be used for both the $I_{\text{sub}} z$ and the $I_{\text{sub}} \theta$ theta/ capacitor banks, with a wide operating voltage range, (2) a crowbar switch which is capable of crowbarring the circuit without the power crowbar bank, and (3) a power crowbar switch, which can handle 50 to 100 coulombs, so that a large number of crowbar switches will not be required when the power crowbar circuit is added. The problems with the start switches and the first crowbar switch have been solved, or alleviated. The development of power crowbar switch has just begun. (ERA citation 03-016258)

Primary Keywords: Power Supplies; Switches; Zt-40 Device; Capacitors; Design; Energy Transfer; Spark Gaps

Secondary Keywords: ERDA/703203; NTISDE

2725
(SWITCHES, CLOSING)
(Gas Gaps, Materials)

RECOIL MOMENTUM AND EJECTION OF METAL PARTICLES UNDER THE ACTION OF A GIANT LASER PULSE
A.M. Bonch-Bruevich and Ya.A. Ines

Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1407-1409
(04/1968).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1917-1920 (October 1967)
The effect of laser radiation with a density exceeding the critical one on a metal target is a rapid heating of a certain metal layer and ejection of metal particles in the form of vapors and drops, the entire target acquiring a certain recoil momentum. The magnitude of this recoil momentum for a number of metals is given for light flux densities approximately $< 168 \text{ Ws}^2/\text{cm}^2$ (continuous wave laser), and for α approximately $< 1.13 \times 10^{-11} \text{ Ws}^2/\text{cm}^2$, on which basis some conclusions can be drawn on the damage mechanism. 4 Refs.

Primary Keywords: Laser-metal Interaction; Mass Ejection; Nd-glass; Laser; Threshold Intensity; Surface Diagnose

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2737
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

MULTICHANNEL HIGH-ENERGY RAILGAP SWITCH

G.R. Neil and R.S. Post
University of Wisconsin, Madison, WI
The Review Of Scientific Instruments, Vol. 49, No. 3, pp 401-403
(03/1978).

A low inductance, multichannel railgap switch has been developed which is capable of switching 20 kJ at 500 kA. The switch has low jitter, a wide operating voltage range and low electrode erosion rate. 4 Refs.

Primary Keywords: Railgap Switch; Multichannel Operation; Low Inductance; Low Jitter; Low Electrode Erosion Rate

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2745
(ENERGY STOPPAGE, MECHANICAL)
(Rotating Machines, Materials)

TEST DATA ON ELECTRICAL CONTACTS AT HIGH SURFACE VELOCITIES AND HIGH CURRENT DENSITIES FOR HOMOPOLAR GENERATORS

M. Brennan (1), W.F. Weldon (1), H.H. Woodson (1), H.G. Rylander (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
(01/1977)

Availability: CONF-771029-121
NTIS

Test data is presented for one grade of copper-graphite brush material, Marganite CM15, over a wide range of surface velocities, atmospheres, and current densities that are expected for fast discharge (<100 ns) homopolar generators. The brushes were run on a copper coated 7075-T6 aluminum disk at surface speeds up to 277 m/sec. One electroplated copper and three flame sprayed copper coatings were used during the tests. Significant differences in contact voltage drops and surface mechanical properties of the copper coatings were observed. (ERA citation 03-025502)

Primary Keywords: Electric Generators; Reference Theta Pinch Reactor; Coatings; Copper; Electric Contacts; Graphite; Mechanical Properties; Performance Testing; Power Supplies

Secondary Keywords: ERDA/700203; DC Generators; NTISDE

2754
(BREAKDOWN STUDIES)

(Gas, Electrical)

A NEW APPROACH TO COMPUTE UNIFORM FIELD BREAKDOWN OF GASES
G. Oliver, Y. Gervais and D. Mukherjee
Ecole Polytechnique De Montreal, Montreal, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 3,
pp 946-956 (1978).

This paper presents a direct method for computing the uniform field breakdown of gases. An equation is derived for calculating the breakdown voltage of a uniform field gap as a function of gas density and gap length. The equation has been verified for several common gases for a wide range of voltage and pressure. 1 Refs.

Primary Keywords: Uniform Field; DC Voltage; AC Voltage; Breakdown Voltage Determination; Several Gases

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

2755
(ENERGY CONVERSION, ELECTRICAL)

(Power Supplies)

A VERSATILE HIGH-VOLTAGE BIAS SUPPLY FOR EXTENDED RANGE MIS C(V) AND G(V) MEASUREMENTS

P. Kucser, H.C. Hoek and A.M. Goodman
RCA Labs, Princeton, NJ 08540
NBS Report No. NBS SP 400-41 (12/1977).

Availability: PB 274 939

NTIS

Recently developed technology has enabled the measurement of MIS C(V) and G(V) at bias-voltage magnitudes as large as 25 kV. This report describes a versatile high-voltage power supply intended for use as a bias source in carrying out such measurements. The design allows the user a wide variety of options in the selection of the sweep function (waveform), sweep time, initial bias voltage, and the amplitude of the bias sweep. There are six possible sweep functions: (i) increasing ramp, (ii) decreasing ramp, (iii) positive polarity half-wave sawtooth increasing ramp followed by decreasing ramp, (iv) negative polarity half-wave sawtooth (decreasing ramp followed by increasing ramp), (v) full-wave sawtooth starting with increasing ramp, and (vi) full-wave sawtooth starting with decreasing ramp. Each single or repetitive sweep may be selected. The sweep time from the start value up to the end of the first ramp segment may be varied from 1 to 2000 s. Operational convenience is enhanced by certain features of the design; among these are light-emitting diodes which display the state of the sweep and automatic pen control if the sweep is used with an X-Y recorder. 5 Refs.

Primary Keywords: Bias Supply; 25 kV Voltage Range; High-voltage Sweep; Single Sweep; Repetitive Sweep; High-voltage C(V) And G(V) Measurement

2779
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas, Optical; Gas Gaps, Optical)

PRESSURE DEPENDENCE OF THE RISE TIME OF LASER-TRIGGERED SPARK GAPS
J.C. Scott and A.W. Palmer
City University, St. John Street, London
Journal Of Physics E: Scientific Instruments, Vol. 11, pp 495-496
(12/1978).

The laser-triggered spark gap (LTSG) has found uses in many applications where ultra-fast voltage transitions are required, primarily because of its reliability of operation, simplicity of construction and speed of response. The LTSG can be incorporated into most coaxial systems with minimum change of impedance, a necessary condition to achieve fast electrical switching. In this communication we report on our practical measurements of the rise times generated by the LTSG which show that, for a certain gap setting, there is a minimum rise time that may be achieved and that the parameters, voltage and pressure, which are determined theoretically to give this minimum rise time are in reasonable agreement with the practically measured values. 6 Refs.

Primary Keywords: Laser-triggered Spark Gap; Deviation From Paschen's Law; Experimental Comparison With Theory

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

2794
(BREAKDOWN STUDIES)

(Surface Flashover)

SPARK DISCHARGE OVER THE SURFACE OF FILMS OF DIFFERENT COMPOSITION

M.P. Vanyurov and E.V. Daniel
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1416-1418
(04/1968).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1927-1929 (October 1967)
Investigations of space and time scans of the channel of a surface discharge and of the charged particle density in the plasma of the channel of a surface discharge have shown that the luminous channel becomes flat and pressed against the surface over which the discharge occurs, whereas the charged-particle density in the discharge channel is distributed non-uniformly and increases with approach to the surface. In view of this it was of interest to determine the effect of the surface on the formation and development of a surface discharge. An investigated discharge gap over the surface of films deposited on different substrates. 3 Refs.

Primary Keywords: Surface Discharge; Current Pressing; $T_{10/2}$; Spatial Resolution; Film; Several Substrates; Spatial Resolution

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

MEASUREMENT OF NANOSECOND HV TRANSIENTS WITH KERR EFFECT
 E.E. Bergmann and G.P. Kolodny
 Lehigh University, Bethlehem, PA
Review of Scientific Instruments, Vol. 48, No. 12, pp 1641-1644
 (12/1977).

A technique for measuring the high-voltage transients associated with low inductance pulsed gas discharges is described. Measurements are made directly at the 10-kV level with a transmission line Kerr cell and narrow-width pulsed dye laser, synchronized with the test discharge. The data indicates a temporal resolution of 2 ns. 9 Refs.

Primary Keywords: Kerr Effect; Laser Synchronizing Pulse

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

(POWER CONDITIONING)

(Pulse Transformers)

THE PREDICTION OF PULSE PERMEABILITY AND LOSS OF Ni/Fe ALLOYS IN

TOROIDAL CORE PULSE CURRENT TRANSFORMERS

P.C. Hoake and A.R. Piercy
 Brighton Polytechnic, Moulsecoomb, Brighton, BN2 4GJ, UK
Journal of Physics D: Applied Physics, Vol. 11, pp 937-944 (11/1977).

Measurements of pulse permeability and loss of Ni/Fe toroidal cores in the unidirectional pulse current transformer mode are reported. These are discussed in comparison with the classical eddy current theory and an improved empirical model developed. 4 Refs.

Primary Keywords: Unidirectional Pulse Transformer; Eddy Current

Theory; Empirical Model; Experiment; Theory

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

(SWITCHES; CLOSING; POWER CONDITIONING)

(Gas Gaps; Self; Transient Suppressors)

AN ELECTRICAL SURGE ARRESTOR (ESA) MODEL FOR ELECTROMAGNETIC PULSE ANALYSIS

C.T. Kleiner, E.D. Johnson, L.R. McMurray and F.T. Suzuki
 Packwell International Electronics Operations, Anaheim, CA 92803
IEEE Transactions On Nuclear Science, Vol. NS-24, No. 6, pp 2352-2356
 (12/1977).

Electrical Surge Arrestors (ESA's) have been used extensively for lightning and gap protection. These devices are characterized by (a) presenting an open circuit (high impedance) below their gap breakdown potential, (b) becoming a virtual short-circuit above the gap breakdown and (c) displaying a significantly higher level of apparent per cent breakdown for very fast input voltage rise-times (dV/dt). This paper describes a mathematical model for a spark gap surge arrester which has been used successfully to characterize ESA response to the following stimulus: 1. Below DC Gap Breakdown 2. At or above Gap Breakdown 3. At high apparent Gap Breakdown voltage as a function of increased rise-time 4. Damaged Sine-wave Input (below and at Gap breakdown) 5. Exposed to prompt gamma radiation using a Flash X-Ray source and an electrical input. 5 Refs.

Primary Keywords: Surge Arrestor; Spark Gap; Modeling; Analysis; Prompt Gamma Radiation

COPYRIGHT: 1977 IEEE. REPRINTED WITH PERMISSION

(SWITCHES; CLOSING)

(Miscellaneous Solid State)

SUBNANOSECOND SWITCH FOR USE IN SHOCK WAVE EXPERIMENTS

T.T. Cole and J.W. Lyle
 Lawrence Livermore Lab., Livermore, CA 94550

The Review of Scientific Instruments, Vol. 42, No. 8, pp 1258-1259
 (08/1971).

A subnanosecond selenium switch has been developed for use in shock wave experiments. Bulk selenium makes a transition to the metallic state at a pressure of 128 kilobars, with a resistivity decreasing by a factor of about 1E11 from the value at atmospheric pressure. A shock wave traversing a selenium film in a direction normal to the film induces the transition. 2 Refs.

Primary Keywords: Selenium Switch; Metallic State; Pressure Transition; 1E11 Resistivity Decrease; Shock Wave Induced Resistance Change

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

(SWITCHES; OPENING; REVIEWS AND CONFERENCES)

(Conferences; Conferences-New)

SYMPHONUM PROCEEDINGS NEW CONCEPTS IN FAULT CURRENT LIMITERS AND POWER CIRCUIT BREAKERS

G. Bates Ed. (1), R. Kennon Ed. (1), and A.S. Gilmore Ed. (2)

(1) Electric Power Research Institute, Palo Alto, CA 94304

(2) State University of New York at Buffalo, Buffalo, NY 14226

EPRI Report No. EPRI EL-276-SR (09/1976)

Availability: EPRI EL-276-SR

EPRI

Serious industry attention is being directed toward developing fault current limiters and improving power circuit breaker interrupters through R&D programs at EPRI, ERDA, and other research organizations. Many of these projects have begun to provide important findings so this symposium was held on September 28, 29, and 30, 1976, at the State University of New York at Buffalo (SUNYAB). The symposium was equally divided between papers and open discussions among the participating researchers, designers, application engineers, and utility operations personnel. Participants expressed their views on such topics as: the concept of protection with breakers, as covered from the fundamental aspects of arc physics to design and development of actual interrupters. Development of gas, vacuum and combination interrupters was discussed. Both switch-hold resistor and turned fault current limiters were presented. Considerable general discussion centered around potential application and need for fault current limiters. Two electric utility papers were presented on the subject of Applications. 125 Refs.

Primary Keywords: Fault Current Limiter; Arc Voltage; Fault Sensing; Arc Interruption; Power Circuit Breaker; Arc Modeling

COPYRIGHT: 1976 EPRI. REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Surface Flashover)

PROPAGATION VELOCITY OF CATHODE-INITIATED SURFACE FLASHOVER

R.A. Anderson

Sandia Lab., Albuquerque, NM 87115

Journal of Applied Physics, Vol. 48, No. 10, pp 4210-4214 (10/1977).

A polymethyl methacrylate insulator rod in vacuum is stressed by 40-mm-long incomplete discharges occur at the cathode end of the rod. Time-resolved measurements of electron emission from different areas on the insulator surface indicate that a discharge propagates toward the anode at approximately 267 m/s during a pulse. A velocity of this order is expected if surface flashover results from an avalanche of electrons due to secondary emission at the insulator surface. Dependence of the velocity on the angle of the electric field relative to the insulator surface is predicted. 14 Refs.

Primary Keywords: Surface Flashover; Vacuum-insulator Interface; Cathode-initiated; Secondary Emission

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

(ENERGY STORAGE)

(Prev. issue)

ENERGY STORAGE OPTIONS FOR SHIVA UPGRADE

B. Ceder and B. Grignon

Lawrence Livermore Lab., Livermore, CA 94550

1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-9 (11/1976). The Shiva Glass Laser at LLNL will use 22-25 MJ of capacitive energy storage. An improved laser system is proposed that will increase this energy requirement by a factor of ten: 25 MJ for Faraday rotators, and 150 MJ for flashlamps. This paper discusses alternative options to capacitors for driving both kinds of loads. Included are homopolar generators that discharge in approximately 0.1 seconds that will drive Faraday rotators directly. Similar generators can be used to drive inductive stores for flashlamp power. The features of the flashlamp system include a wide distribution of 10 kJ load elements, and a half-millisecond discharge time requirement. The possibilities of providing open-switching for inductive storage and of driving many flashlamps in parallel are discussed. 5 Refs.

Primary Keywords: High Energy Storage Requirements; Capacitive Energy Storage; Homopolar Generator; Inductive Energy

Storage

Secondary Keywords: Shiva Glass Laser

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

(ENERGY STORAGE; MECHANICAL)

(Rotating Machines)

CONTROLLABLE HOMOPOLAR MOTOR-GENERATOR ENERGY STORAGE FOR APPLICATION IN A FUSION POWER REACTOR

W.Y. Chen, W.E. Toffolo and J.R. Purcell

General Atomic Co., San Diego, CA 92121

1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-3 (11/1976). Homopolar motor-generators are considered as likely candidates for the energy storage devices to be used in conjunction with rapidly pulsed plasma fusion reactors. In a tokamak fusion reactor, the induction coil will be a pulse coil and it is likely to be superconducting. Then an HMG will be the most economical and efficient energy storage device. However, it is highly desirable to control the HMG effective capacitance in order to shape the induction coil current waveform and utilize the full volt-second capability of the coil. Then it is important to minimize the stored energy in the HMG excitation coils in order to reduce the power required for controlling the HMG. Investigations have been made to optimize the current of controllable HMG. The excitation coil stored energy and the machine cost are minimized in the process. The study has been concentrated on drum type HMGs. It was found that for an HMG assembly with a total capacity of 1500 MJ, the excitation coil stored energy can be as low as 10 MJ. Thus, the scheme for controlling the effective capacitance of the HMG appears to be feasible. 4 Refs.

Primary Keywords: Homopolar Generator; Motor-generator; Output Pulse Shaping; Controllable Excitation Coil

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

(ENERGY STORAGE; MECHANICAL)

(Rotating Machines)

PRELIMINARY ENGINEERING DESIGN OF A PULSED HOMOPOLAR GENERATOR POWER SUPPLY

W.L. Bird, W.G. Dene, G.B. Grant, H.G. Rylander, K.M. Tolok, W.F. Weldon and D.H. Wohlgemuth

1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-12

A 22/2 megajoule 500 volt homopolar generator system is proposed as the initial storage-conversion device for the Texas Experimental Tokamak. The initial engineering design of a 50 megajoule 125 volt homopolar generator module is presented and major components: conductors and their overshoot bearing, brushes and armature conductors are detailed. The support for this work was provided by the Energy Research and Development Administration and the Texas Area Energy Research Foundation. 0 Refs.

Primary Keywords: Homopolar Generator; Engineering Design; Component Design

Secondary Keywords: Tokamak; Toroidal Field Coil

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

(SWITCHES; CLOSING)

(Vacuum Arcs; Electrical)

VACUUM ARC VACUUM-ARC SWITCHED MULTI-MEGAWATT INVERTER TESTS

A.G. Gilmore and A.H. Klimstra

State University of New York at Buffalo, Buffalo, NY 14226

1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-4 (11/1976).

This paper studies how the possibility of using a vacuum arc as a high power force commutated or series commutated inverter circuits. One such application, discussed in this paper, is in the development of a 10,000 volt, multi-megawatt series capacitor inverter circuit. Initial testing has been performed on a 10 kHz 10,000 volt L-C circuit using a VAS. Single pulse tests at 3000 A peak and 5000 V have been very successful. Extensive energy loss studies of the various circuit components result in predicted inverter efficiencies in excess of 95 percent. The tests show that these high efficiencies will be achievable if high quality circuit components are used. The inductors must be fabricated from litz wire. Low loss materials must be used for the capacitors and distributed connections must be made to capacitor elements. The configuration and connection of the electrodes in the VAS must be such as to minimize the output voltage drop. 4 Refs.

Primary Keywords: Vacuum Arc; Switched Inverter; Vacuum Gap; Ignitor

Switching

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

2899

(DIAGNOSTICS AND INSTRUMENTATION)

(Data Transmission)

ST 100: DATA ACQUISITION FROM HIGH VOLTAGE TERMINALS
 G.H. York, J.T. Park, J.J. Miskinis, D.M. Grandell and V. Pol
 University of Missouri-Rolla, Rolla, MO 65401
The Review Of Scientific Instruments, Vol. 43, No. 2, pp 230-232
 (02/1972)

An inexpensive data acquisition system has been designed to provide high voltage isolation for data acquisition to analog, digital, and pulse modes. The telemetry system uses GaAs light sources, fiber optics, and phototransistors to accomplish the data transmission. Prewired logic boards have been adapted to accomplish the timing and logic functions. Seven decades of digital data are transmitted error free. Pulse data can be transmitted at rates up to 10 Hz, and analog data are transmitted with 0.05% full scale accuracy. 6 Refs.

Primary Keywords: Fiber Optic; Electrical Isolation; GaAs Diode; Phototransistor; 1 MHz Bandwidth

COPYRIGHT 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2957

(BREAKDOWN STUDIES)

(Gas, Electrical)

THE ROLE OF THE CATHODE ZONE IN THE TRANSITION CORONA EFFECT ARC
 P. Bertault, J. Dupuy and A. Gibert
 Institut Universitaire de Recherche Scientifique, Chemin Philidor, Peu, France
Journal of Physics D: Applied Physics, Vol. 10, No. 16, pp L219-L222
 (11/1977).

In the transition corona effect arc, in atmospheric air, for internal electrode distances less than a few centimetres, the point-to-plane parameter (the minimum DC positive voltage being applied to the point with the plane at earth potential) is dependent on the existence of a cathode zone and a 'cathode canal'. A sufficient reserve of energy (internal capacity in parallel with the spark gap) permits the 'cathode canal' to develop into a transient arc which is extinguished when the capacity has discharged itself. However, the increasing duration of the cathode zone, with increasing total current, leads to a continuous luminous discharge (named a 'silent' arc) which then evolves into an arc for high currents. 4 Refs.

Primary Keywords: Atmospheric Air; Cathode Zone; Point-to-plane Geometry; Cathode Canal

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2958

(BREAKDOWN STUDIES)

(Gas, Electrical)

THE USE OF A PHOTOMULTIPLIER IN THE DETERMINATION OF IONIZATION COEFFICIENTS IN GASES STRESSED WITH HIGH VOLTAGE
 H.M. Banford and D.J. Tedford
 University of Strathclyde, Glasgow, Scotland
Journal of Physics D: Applied Physics, Vol. 10, No. 16, pp 2177-2180
 (11/1976).

Experiments using a photomultiplier in the determination of the effective ionization coefficient of ambient room air stressed at very high voltage are described, and the results compared with data previously obtained by conventional current measurement techniques. Good agreement has been achieved, and the advantages of the photomultiplier method are discussed. 8 Refs.

Primary Keywords: Ionization Coefficient; Air; Photomultiplier; Current Measurement; Uniform-field Gap; Alpha-particle Irradiation

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2976

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Gas Gaps; Recovery)

THE INFLUENCE OF ELECTRODE HEAT TRANSPORT IN SPARK RECOVERY
 F.L. Curzon and H.S. Guttman
 University of British Columbia, Vancouver, British Columbia, Canada
Journal of Physics D: Applied Physics, Vol. 10, pp 73-87 (01/1977).

A one-dimensional model of heat flow in a recovering spark channel is presented, taking into account the effect of electrode heat transport. The theory indicated that the ratio of the times taken for spark channels equipped with different electrodes to achieve the same recovery voltage is constant over a wide range of voltages. The value of the constant depends on the thermal constants of the spark channel and electrode materials. Recovery measurements have been carried out on spark gaps operated in air between tungsten, copper and stainless-steel electrodes. The copper and stainless-steel electrodes were capped by thin tungsten layers to keep the surface properties fixed. The experimental results agree well with the theory provided the recovery voltage lies between 10 and 75% of the final breakdown potential of the spark channel. The results also show that for tungsten electrodes electrode heating has a minor, but significant, effect on the recovery characteristics. 4 Refs.

Primary Keywords: Spark Recovery; Heat Flow; Modeling; 1-d Simulation; Several Electrode Materials

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

2993

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Surface Flashover; Gas Gaps; Materials)

AVOIDING FLASHOVERS IN LOW INDUCTANCE HIGH VOLTAGE SPARK GAPS AT ATMOSPHERIC PRESSURE
 M. De Pretis
 Centre d'Etudes Nucleaires, Boite Postale N. 6, 92 Fontenay-aux-Roses, France
The Review Of Scientific Instruments, Vol. 41, No. 6, pp 889-891
 (06/1970)

The major problem when designing a high voltage spark gap is represented by flashovers occurring on the inner surface of the main insulator, and which strongly depend on the insulating materials used as well as their surface state and shape. For voltages up to 20 or 30 kV, the breakdown distance for flashovers on Teflon is practically linear and almost three times larger than in air. For higher voltages it increases more rapidly and we observed flashes over more than 40 cm occurring within 100 nsec after a potential difference of approximately 100 kV was applied. 2 Refs.

Primary Keywords: Insulation; Flashover; Teflon; Coronal Spark Gap; Low Inductance; Air Gap

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3006

(SWITCHES, CLOSING)

(Gas Gap; Crossed-field)

HIGH AVVERAGE POWER TESTS OF A CROSSED-FIELD CLOSING SWITCH
 R.J. Harvey (1), R.W. Holly (1) and J.E. Creedon (2)
 (1) Hughes Research Labs, Malibu, CA 90265
 (2) EG&G, Fort Monmouth, NJ 07703
 1976 IEEE Pulsed Power Conference Proceedings, Paper 1B-2 (11/1976).

A triode version of the crossed-field closing switch has been successfully tested at average powers of up to 100 W for burst durations of 30 s. Unlike most conventional spark gaps, the arc is initiated from a crossed-field glow discharge and occurs at random locations on a shot-to-shot basis. This uniformly disperses the heat loading and erosion over a relatively large electrode surface area which may then be cooled. 4 Refs.

Primary Keywords: Crossed-field Closing Switch; Triode; Glow Discharge; Performance

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

3014

(BREAKDOWN STUDIES)

(Gas, Electrical)

IMPULSE FLASHOVER CHARACTERISTICS OF LONG AIR GAPS AND ATMOSPHERIC CORRECTION

Y. Aihara (1), Harada T. (1), Y. Ito (1) and Y. Aoshima (2)
 (1) Central Research Institute Of Electric Power Industry, Tokyo, Japan
 (2) Meidensha Electric Mfg. Co., Ltd., Numazu, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 2, pp 342-348 (03/1978).

The flashover voltages of long air gaps such as rod-rod and rod-plane gaps vary with impulse waveform, polarity, gap spacing and atmospheric conditions. This paper deals with the results of analysis of the flashover characteristics for various impulse waveforms of positive and negative polarities, measured in many laboratories including CRIEP. New and general relations were found between flashover voltages and the factors mentioned above, thereby enabling determination of flashover voltages under various test conditions. 9 Refs.

Primary Keywords: Rod-plane Gaps; Rod-rod Gaps; Impulse Flashover; Atmospheric Consideration

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

3024

(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Surface Flashover; Solid)

BREAKDOWN OF INSULATING MATERIALS BY SURFACE DISCHARGE

Y. Toriyama (1), H. Okamoto (2) and M. Kanazashi (3)
 (1) Musashi Institute of Technology, Tokyo, Japan
 (2) Central Research Institute of the Electric Power Industry, Tokyo, Japan
 (3) Electrotechnical Lab, Tokyo, Japan
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 124-129 (09/1971).

'Round-robin' experiments for partial discharge degradation of polyethylene have been made by means of a parallel-plate electrode system. Following this, a second round-robin was run using direct electrodes with the object of surveying some simple testing methods corresponding to actual phenomena such as local perforation by corona. Corona lifetimes of several insulating materials were measured by using two kinds of electrode systems, i.e., a hemisphere-plane configuration and a cylinder-plane as recommended by the International Electrotechnical Commission (IEC). Results of differences between different materials cannot be defined because of the fluctuation of corona lifetime of the same material, but there may be some significance in the order of six kinds of materials. Several possible causes of the variability were examined with regard to the differences of test dates, humidities, airflows, and specimens' thickness and some information concerning relations between variability and experimental conditions was obtained. These results and considerations should be helpful relative to the adoption of the most reasonable electrode and the performance of test procedure. 9 Refs.

Primary Keywords: Partial Discharge; Local Perforation; Corona; Insulation Lifetime; Test Procedure

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

3030

(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)

(Component Testing; Current)

MEASUREMENT PROCEDURES FOR CHARACTERIZATION OF HIGH VOLTAGE SPARK SOURCES

A. Scheeline, D.M. Coleman and J.P. Walters
 University of Wisconsin, Madison, WI
Applied Spectroscopy, Vol. 32, No. 2, pp 215-223 (04/1978).

A new technique called 'capacitor discharge spark source' procedures and devices needed in the measurement of both individual components and systems used in capacitor charging, and in the control and monitoring of the discharge current are discussed. Characterization methods and their applications to source development is examined. 16 Refs.

Primary Keywords: Capacitive Discharge Spark Source; Pulse Shape Programming; Spectroscopic Measurement

COPYRIGHT: 1978 SOCIETY OF APPLIED SPECTROSCOPY

3045

(BREAKDOWN STUDIES)

(Gas, Electrical)

CALCULATION OF SPARK BREAKDOWN OR CORONA STARTING VOLTAGES IN NONUNIFORM FIELDS

A. Pedersen
 Technical University of Denmark, Lyngby, Denmark
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-85, No. 2, pp 202-206 (02/1967).

The processes leading to a spark breakdown or corona discharge are discussed very briefly. A quantitative breakdown criterion for use in high-voltage design is derived by which spark breakdown or corona starting voltages in nonuniform fields can be calculated. The criterion is applied to the sphere gap, and it is shown how it can give a very detailed and accurate description of known breakdown characteristics. 12 Refs.

Primary Keywords: Gas Breakdown; Spark; Corona; Breakdown Threshold; Nonuniform Field; Theory; Townsend Ionization; Sphere-sphere Gap; Insulation Design Criteria

COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION

3069
(BREAKDOWN STUDIES)

(Gas; Optical)
BACKGROUNDS GAS PRESSURE DEPENDENCE AND SPATIAL VARIATION OF SPONTANEOUSLY GENERATED MAGNETIC FIELDS IN LASER-PRODUCED PLASMAS

R.S. Case Jr. (1) and F. Schwirzke (2)

(1) AFWL, Kirtland AFB, NM 87117

(2) Naval Postgraduate School, Monterey, CA 93940

Journal Of Applied Physics, Vol. 46, No. 4, pp 1483-1498 (04/1975).

A spontaneous azimuthal magnetic field generated by electron currents which flow during the interval that a high-brightness 4-nsec full width at half-maximum intensity ruby laser was incident on a metallic target has been detected. Its spatial characteristics evaluated, and its dependency upon background gas pressure investigated both experimentally and theoretically. The propagation velocity of the self-induced azimuthal magnetic field is greater than 165 cm/sec, more than an order of magnitude larger than the plasma convective velocity, and indicates that the electron currents responsible for this fast field must flow through the background photoionized gas. The early component is first detected at a pressure of 5E-6 Torr, and for a fixed spatial location, reaches a peak intensity at a pressure of 2E-3 Torr. Its intensity is typically on the order of 1-10 G, a factor 10-100 times smaller than the spontaneously generated magnetic fields which are driven by pressure gradient effects in the expanding laser plasma. The pressure dependence of the pressure gradient magnetic field has also been evaluated and compared with previous experimental results, obtained at laser pulse lengths of greater than 20 nsec. 14 Refs.

Primary Keywords: Gas Breakdown; Laser Breakdown; Metal Target; Ruby Laser; Variable Gas Pressure

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3070
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, MECHANICAL)

(Systems; Rotating Machines)

AN INDUCTIVE ENERGY STORAGE SYSTEM BASED ON A SELF-EXCITED HOMOPOLAR GENERATOR

A.E. Robson, R.E. Lohman, W.H. Lupton, T.J. O'Connell, P.J. Turchi and

W.L. Warnick

Naval Research Lab, Washington, DC 20375

IEEE Sixth Symposium On Engineering Problems Of Fusion Research pp.

298-302 (11/1975).

A 10 MJ inductive energy storage system is described in which the storage coil is also the excitation coil of a homopolar generator. Energy is stored initially in two counter-rotating rotors and transferred to the coil when the generator is connected in a self-excited mode. The circuit is interrupted by a large sulfurhexafluoride circuit breaker working in conjunction with a fuse, and delivers energy to a resistive load in approximately 1 ms. The system contains a number of novel features, including very high-speed rotors and carbon fiber brushes. It is intended as a prototype module for large energy storage systems. 19 Refs.

Primary Keywords: Homopolar Generator; High Speed Rotors; Circuit Breaker; Sulfurhexafluoride; High Energy

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

3105
(PULSE GENERATORS)
(Trigger)

AVALANCHING TRANSISTORS SPEED UP HIGH-VOLTAGE PULSES

E.A. Jung, Argonne, IL

Electronics, Vol. 44, No. 2, pp 73 (01/1971).

A circuit producing variable pulses of 200-400 volts with rise and fall times of 30 ns is designed using a vacuum tube and a transistor. A 2 kHz repetition rate at a 1% duty cycle is possible. 0 Refs.

Primary Keywords: Avalanche Transistor; Vacuum Tube; Fast Rise;

Hundreds Of Volts Output

COPYRIGHT: 1971 McGRAW-HILL, INC.

3131
(PULSE GENERATORS)

(Marx)

STABILIZATION OF THE TIME CHARACTERISTICS OF AN ARKAD'EV-MARX GENERATOR

I.Ye. Antropov, Yu.V. Kuznetsov, E.V. Lazutin, I.M. Piskarev, V.A.

Khrushchev, and A.V. Shumakov

Scientific-Research Institute Of Nuclear Physics, Moscow State

University, Moscow, USSR

Instruments And Experimental Techniques, Vol. 19, No. 2, pp 429-431

(04/1976).

Trans. From: Priroby i Tekhnika Ekspertimenta 2, 99-100 (March-April

1976).

A method is proposed for stabilizing the actuation time delay and the fluctuations of this time delay in an Arkad'ev-Marx generator. The method allows the output voltage of the generator to be varied within limits of approximately 35% without controlling the spark gaps and makes it possible to avoid purging the spark gaps during operation. 1 Refs.

Primary Keywords: Arkad'ev-Marx Generator; Jitter Stabilization; Large Operating Voltage Range; Trigger Optimization

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

3150
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)

(Magnetic Flux Compression)

EXPLOSIVELY PRODUCED MEGAOUAUS FIELDS AND APPLICATIONS

C.M. Fowler, R.S. Caird, D.B. Gorn and D.J. Erickson

Los Alamos National Labs, Los Alamos, NM 87545

IEEE Transactions On Magnetics, Vol. MAG-12, No. 6, pp 1018-1023

(11/1976).

We describe various explosive magnetic flux compression devices that produce pulsed megagauss fields, and a number of applications in which they have been used. Among the systems described are relatively simple ones that generate fields up to 250 T in large fixed volumes, and cylindrical implosion systems that produce fields in excess of 1000 T. Small fixed volume systems are described that may be used in the laboratory. They require only small amounts of explosive and can produce 100 T fields in coils 25 mm long and 10 mm diameter. We discuss measurements made on various materials in negative magnetic fields, off-resonance temperature, including magnetooptical, magnetic susceptibility, optical absorption, Faraday rotation, and Zeeman splittings. We also discuss experiments in which large magnetic pressures have been used to compress solid deuterium isentropically. In flux compression devices part of the energy of the explosives is converted to electromagnetic energy. This has led to their use as compact single-shot high power energy sources. At this time, it is necessary to transformer couple loads to the device outputs. We describe successful operation to transformers in 165 T fields, and suggest that they can operate in much higher fields. 22 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression;

Explosive Driver; Laboratory Size Generator;

Application

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

3151
(SWITCHES; CLOSING; SWITCHES; CLOSING)

(Mechanical; Gas Gaps; Solid)

GENERATOR PRODUCING SINGLE NANOSECOND PULSES WITH CONTROLLABLE AMPLITUDE AND DURATION

A.I. Aleksandrin and I.S. Semenov

Instruments And Experimental Techniques, Vol. 19, No. 4, pp 1092-1095

(08/1976).

Trans. From: Priroby i Tekhnika Ekspertimenta 4, 142-144 (July-August

1976).

A generator is described which produces single nanosecond pulses having a rectangular shape with a mechanically commutated spark gap in hydrogen under a pressure of 50 gauge atmospheres; the amplitude of the pulses is 10-5000 V, and the duration of the leading edge is <0.1 nsec. 7 Refs.

Primary Keywords: Micro-wetted Delay; Peaking Spark Gap; Subnanosecond Rise-time; 5 kV Operating Voltage; 50 Atmospheric Pressure

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

3154
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas; Optical; Gas Gaps; Optical)

CASCADE IONIZATION OF A GAS BY A LIGHT PULSE

Ya.B. Zel'dovich and Yu.P. Reizer

Soviet Physics JETP, Vol. 20, No. 3, pp 772-780 (03/1965).

Trans. From: Zhurnal Ekspertimentalnoi i Teoreticheskoi Fiziki 47,

1150-1161 (September 1964).

The mechanism of ionization of a gas under the action of a light pulse is considered. The case is investigated when the pulse power and electric field strengths in the light wave are not very large and the light-induced emission of electrons is not of decisive importance. Under these conditions ionization is of a cascade nature, the electrons absorb light quanta in collisions with neutral atoms and accumulate enough energy sufficient for ionization. Approximate calculations of the kinetics of development of the cascade are conducted by taking into account the most important processes. Results of calculation of the breakdown fields are compared with published experimental data. 9 Refs.

Primary Keywords: Laser Ionization; Volume Ionization; Cascade Ionization; Low Laser Power; Helium Gas; Argon Gas; Ruby Laser; Theory

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3175
(BREAKDOWN STUDIES)

(Gas; Electrical)

DIELECTRIC BREAKDOWN OF SULPHUR HEXAFLUORIDE IN NEARLY UNIFORM FIELDS

Y. Kawaguchi, Y. Sakata and S. Manju

Tokyo Shibaura Electric Co. Ltd., Yokohama, Japan

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3,

pp 1072-1078 (06/1971).

This paper describes the breakdown potential gradient of sulphur hexafluoride (SF₆) at pressures up to 4 kg/sq.cm. absolute against power frequency, switching impulse and standard impulse voltages in nearly uniform fields such as plane-plane, sphere-sphere, and coaxial cylinder electrode configurations. Electrode material, smoothness and polarity effect are also investigated for coaxial cylinders. Test results indicate that potential gradient is the most influential factor in the dielectric breakdown of SF₆. Switching impulse and standard impulse breakdown at positive polarity occur at the potential gradients close to a limiting value of E/P = 86.1 (kV/cm/kg/sq.cm.) measured by Geballe and Reeves. Breakdown potential gradient at negative polarity is below the limiting value of E/P at pressures above 1 kg/sq.cm. The negative breakdown seems to be more dependent on electrode area and duration of applied voltages. 9 Refs.

Primary Keywords: Uniform Field; Several Electrode Materials; Surface Condition; Polarity Effect; Power Frequency Voltage; Impulse Voltage; High Pressure

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

3185
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

CAPACITIVE MEASUREMENTS OF SLOW FLUCTUATIONS IN HIGH-VOLTAGE SUPPLIES FOR ELECTRON MICROSCOPES

H-P. Rust, K. Weiss and P. Ziliske

Institut Fur Elektronenmikroskopie, Am Fritz-Haber-Institut Der

Max-Planck-Gesellschaft, Berlin, GDR

Journal Of Physics E: Scientific Instruments, Vol. 10, No. 1, pp 71-72

(01/1977).

1 Refs.

Primary Keywords: Capacitive Measurement; Low Frequency; Capacitor Leakage Current; Leakage Current Drift; Leakage Current Error

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3188

ELECTRICAL BREAKDOWN AND TRACKING CHARACTERISTICS OF PULSED HIGH

VOLTAGES IN CRYOGENIC HELIUM AND NITROGEN

P.A. Haenninen and K.D. Hillis-Son

Los Alamos National Labs, Los Alamos, NM 87545

No. CONF-7507-16, 16p (01/1975).

Availability: LA-UR-75-1032 NTIS

The proposed Scyllac Fusion Test Reactor (SFTTR) at the Los Alamos Scientific Laboratory (LASL) anticipates using superconducting coils as the main energy storage device and will store a total energy of 400 MJ. The SFTTR will operate in a pulsed mode with the superconducting energy storage system-METS (Magnetic Energy Transfer System)-experiencing a 60 kV pulsed voltage during each pulsed operation. This paper presents experimental data for use by engineers in the design of cryogenic apparatus that will be subject to the SFTTR 60 kV pulsed waveform. Various electrode configurations were used in order to provide the designer with a wide range of commonly used geometries over the widest practical range of helium and nitrogen temperatures from liquid to room temperature at pressures of 0.9 and 1.6 atm. Data are also presented on voltage tracking characteristics of Mylar, polyphonic, polyethylene, nylon, teflon, and permalloy, which are commonly used structural dielectric materials.

Primary Keywords: Scyllac Devices Specifications; Dielectric Materials Breakdown; Cryogenics; Electric Potential; Electrical Insulation; Helium; Nitrogen; Superconducting Magnets

Secondary Keywords: NTISERDA

60

3191
(PULSE GENERATORS; POWER CONDITIONING)
(L.C.; Pulse Transformers)

CIRCUIT FOR SHAPING SHORT HIGH-VOLTAGE PULSES
M.I. Elagin, V.V. Starikh and S.D. Fanchenko
Institute Of Atomic Energy, Moscow, USSR
Instruments And Experimental Techniques, No. 2, pp 438-439 (04/1970);
Trans. From: "Priroby i Tekhnika Ekspertnaya", 110-115 (March-April
1970).

The paper describes a generator which produces single pulses and solves the problem of producing short high-voltage pulses at a power level of 1.62 to 1.63 MW across the circuit of a plasma turn. The pulses are produced in the secondary winding of a coreless transformer. Two high voltage spark gaps and a nonlinear varistor resistor are used as the commuting elements. Single pulses having a length of 0.3 microsecond and an amplitude of up to 40 kV are obtained. 2 Refs.

Primary Keywords: Pulse Transformer; Air Core Transformer; Spark Gap;
Copyright: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

3192
(SWITCHES, CLOSING)
(Gas Caps; Elect. coll.)

ANALOGUE OF A VACUUM SHORT RECOVERY TIME HIGH-VOLTAGE SWITCH
H. Dufour, M. Fournier and R. Sohl, 9
Institute Of Phys., Univ. de Berne, Switzerland
Revue Nucl. Instur. Vol. 47, No. 12 pp 1552-1 53 (06/1976).

A novel semiconductor high-pressure switching discharge gap capable of switching voltages up to 35 kV has been built. A recovery time of a few microseconds was measured, allowing switching rates in the 100 kHz range. 2 Refs.

Primary Keywords: Very Low Pressure Gaps; Short Recovery Time; Porous
Dielectric; High Resistance
Copyright: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

3193
(PULSE GENERATORS)
(Trigger)

OPTICALLY ISOLATED HIGH-VOLTAGE TRIGGER SYSTEM

I. Honing and M.S. Kably
Los Alamos National Lab., Los Alamos, NM 87545
The Review of Scientific Instruments, Vol. 47, No. 2, pp 168-170
(02/1977).

An optically isolated high-voltage trigger system has been built to eliminate ground loop and electromagnetic interference problems in the triggering of a pulsed high-voltage plasma experiment. In this system fast-rising light pulses are generated at the trigger source and transmitted through 20 m long glass fiber optics cables to detectors, which trigger 7-kV pulsers used to drive high-voltage spark gap switches. The 7-kV pulsers are battery powered and may be floated to the potentials existing on the spark gaps. 9 Refs.

Primary Keywords: Optical Isolation; Battery Operation; Long Battery
Life; 7-kV Output; 6 ns Rise Time; 3 ns Jitter
Copyright: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

3228
(CIRCUIT CALCULATIONS)
(Capacitance)

CAPACITANCE CALCULATIONS FOR SOME BASIC HIGH VOLTAGE ELECTRODE
CONFIGURATIONS

P. Maruyeda and H. Hytun-Cavallius
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-94, No. 5,
pp 1708-1713 (09/1975).

Calculation of the capacitance to ground, as well as of the capacitance between objects of various shapes is a problem occurring frequently in high voltage engineering. Simple methods do not exist, however, for such calculations, even in the case of the basic electrode configurations. Although general purpose computer programs may have been developed for most of the configurations, their availability is rather limited, and the data preparation often cumbersome. Accurate computer calculations of the capacitance to ground have been made for a large number of electrode configurations. The results are presented graphically in a normalized form, and should permit a rapid and precise determination of capacitances for most practical electrode arrangements. Furthermore, some simple equations have been developed which permit an approximate, but often sufficiently accurate, evaluation of the capacitance by hand calculations. It is believed that both the accurate graphs and the simple equations would be of great practical value, especially to high voltage engineers. 9 Refs.

Primary Keywords: Sphere; Circular Disc; Horizontal and vertical
Rectangular; Arcuated; Normalized curves; Charge
Distribution Determination

Copyright: 1975 IEEE, REPRINTED WITH PERMISSION

3242
(PULSE GENERATORS)
(Hard-tube)

HIGH POWER MODULATOR/REGULATORS FOR NEUTRAL BEAM SOURCES

J.G. Lawson and A. Deltz
Princeton University, Princeton, NJ
Availability: CONF-751125-131
NTIS

PPPL has recently completed two new Modulator/Regulators for neutral injection sources based on the ATC machine and is constructing four new ones for use with sources of the PLT machine. The ATC modulator uses the all proton drift space tetrode as the main switch tube, while the PLT modulators will use a new, but significantly higher powered X-2170 tetrode. Some interesting circuit and manufacturing techniques are discussed.

Primary Keywords: ATC Devices; Neutral Atom Beam Injection; Neutral
Atom Beam Injection Power Supplies; Ion Sources;
Modulator; Switches

Secondary Keywords: NTISERPA

3251
(BREAKDOWN STUDIES; INSULATION, VACUUM)
(Surface Flashover)

INSULATOR FLASHOVER MECHANISM IN VACUUM INSULATED CRYOCABLES
P. Grenney and D.B. Montgomery
Massachusetts Institute of Technology, Cambridge, MA
Journal of Vacuum Science And Technology, Vol. 13, No. 5, pp 1081-1087
(10/1975).

The authors present evidence that surface flashover in vacuum is largely due to gases absorbed at the insulation surface. Cryogenic underground power cables are considered in experiments in the conditioning effect in vacuum insulation, insulation damage experiments, and flashover mechanism investigations. It is shown that the early stages of surface flashover are the results of discharges in the unabsorbed gases. 11 Refs.

Primary Keywords: Vacuum Insulation; Surface Flashover; Conditioning;
Insulator Damage; Lichtenberg Discharge

Copyright: 1976 THE AMERICAN VACUUM SOCIETY

3253

(BREAKDOWN STUDIES)

(Electrodes)
IONIZATION, ELECTRODE SURFACES AND DISCHARGES IN SF₆/SUB 6/ AT
EXTRA-HIGH-VOLTAGES

C. Cooke
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-94, No. 5,
pp 1518-1523 (09/1975).

The influence on SF₆ electrical performance of SF₆ gas from small protrusions on electrode surfaces has been investigated, especially in a system of moderate size over the pressure range 1/4 to 15 atm abs. The protrusions used were steel or aluminum spheres with 0.019cm radius or a rod 10 times higher than their tip radius of 0.019cm. Over the complete voltage range, 100 kV to 1500 kV, good agreement was found between measured values and those calculated using a simple ionization development model for discharge initiation. This simple model was applied to calculate the effect of other protrusion shapes. In each case when the product of gas pressure times protrusion height above a flat electrode exceeded 80 atm-microns, their presence decreased the breakdown stress. Scanning microscope views of the sphere tips after sparking showed microscopic protrusions which account for the deterioration found after the first spark. 15 Refs.

Primary Keywords: Effects of Small Protrusions On Electrode Surface,
1/4 To 15 Atm Abs; Spherical Protrusions; 100 kV To 1500 kV; Pressure-protrusion Height Product;

Scanning Microscope Data; SF₆ Insulated Equipment

Copyright: 1975 IEEE, REPRINTED WITH PERMISSION

3254

(BREAKDOWN STUDIES)

(Gas, Electrical)
NANOSECOND VOLUME DISCHARGE IN AIR AT ATMOSPHERIC PRESSURE

S. Andreev and G. Novikova
Affiliation Not Given
Soviet Physics Technical Physics, Vol. 20, No. 8, pp 2078-2084
(08/1976).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 65, pp 1692-1703
In the breakdown of air in air at atmospheric pressure at high overvoltages, an electron density reaches 10¹⁶ cm⁻³, and the glow regions clearly defined boundaries in the region of ionization ionization, which emits a continuum. The line emission forms a packet which gives the glow region a diffuse shape in white light. A model of the nonequilibrium plasma is analyzed; it can be used to calculate the electron temperature and drift velocity. The quasistatic nature of the current and voltage is attributed to the initial lag in the gas heating, due to the heat capacity of the gas. Ionization processes are inhomogeneous over the length of the gap. A region with an elevated charged-particle density develops from the cathode toward the anode while there is a quasistatic voltage between the electrodes. The contraction process, which completes the volume-discharge stage, turns out to be due to an avalanche increase in the electron density as the conditions for equilibrium thermal ionization are approached. 31 Refs.

Primary Keywords: Slow Voltage Pulse; Volume Glow; Avalanche Increase
In Electron Density; Hemispherical Electrodes;
Pointed Electrodes

Copyright: 1976 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

3275
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)

(Generation, System)
ACCELERATOR AND SWITCHING OPTOELECTRONIC SYSTEM OF A HIGH-POWERED
ACCELERATOR WITH AN INDUCTIVE STORAGE ELEMENT

I.N. Sil'kov and G.I. Dolgachov
Instruments And Experimental Techniques, Vol. 18, No. 3, pp 688-691
(06/1975).

Trans. From: Priroby i Tekhnika Ekspertnaya, 3, 27-30 (May-June 1975).
The characteristics and design of an optoelectronic system are considered, which in a high-powered pulsed electron accelerator with an inductive energy storage element, provides current switching and generation of a beam of accelerated electrons. The circuit of an accelerator with this optoelectronic system is described. 5 Refs.

Primary Keywords: E-beam Generation; Inductive Energy Storage;

Optoelectronic System; Variable Perveance

Copyright: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

3286
(PARTICLE BEAMS, ELECTRON)

(Generation)

COLD CATHODE ELECTRON GUNS IN THE LASL HIGH POWER SHORT-PULSE CO/SUB 2/
LASER PROGRAM

S. Singer, J.S. Ladish and M.J. Nutter
Los Alamos National Lab., Los Alamos, NM 87545
No. CONF-751108-14, 246 (01/1975).

Availability: NTIS

The design, operation, and performance of the 200 x 35 cm exp 2 two 5 rad cold cathode electron guns used in the 2.5 kJ laser system

and to be used in the 10 kJ laser are described.

Primary Keywords: Carbon Dioxide Lasers; Electron Beams; Electron
Sources; Design; Control Systems; Operation; Performance

Secondary Keywords: Cold Cathodes; Electron Guns; NTISERDA

- 3287
 (SWITCHES; CLOSING)
 (Vacuum Gaps; Electrical)
CONTROLLED VACUUM SPARK GAPS RATED AT A VOLTAGE OF 50 KV FOR MULTIPLE COMMUTATION OF MEGA-AMPERE CURRENTS
 P. N. Dashuk and G. S. Kiricheva
 Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 463-465
 (4/1975).
 Trans. From: *Pribory i Tekhnika Eksperimenta* 2, 113-115 (March-April 1975).
- The construction and the results of an experimental study of vacuum spark gaps suitable for multiple commutation (>5000 "makes") of current pulses having an amplitude of 114 to 1.2E6 A and a length of about 11-3 μ s to 18-5 μ s in capacitive storage devices having the energy of approximately 50 kJ are presented. The time delay between gap operation at a pressure of 0.667 Pa and at voltages of 10 to 50 kV is equal to approximately 0.7 microseconds, and at voltages of 10 to 100 kV it is equal to approximately 20 microseconds. The distribution of the time delay corresponds to a normal law. The dielectric strength of the gaps has an insulation of the spark gaps after multiple commutation of currents having various shapes amounts to 60 and 65%. The inductance of the spark gap is 6 nH, 3 Refs.
- Primary Keywords: Vacuum Spark Gap; 50 KV Operating Voltage; 1.2 MA Current; 6 NH Inductance; Delay Measurement; Jitter Measurement; Life Test
- COPYRIGHT: 1975 PLENIN PRESS. REPRINTED WITH PERMISSION
- 3290
 (VACUUM GENERATORS)
 (Switches; Closing)
FUNDAMENTAL LIMITATIONS AND TOPOLOGICAL CONSIDERATIONS FOR FAST DISCHARGE HOMOPOLAR MACHINES
 M. D. Dr. phil. S. A. Nasar, H. G. Fylinder, W. F. Wilson and H. H. Woodson
Proceedings At Austin, Austin, TX
IEEE Transactions On Plasma Science, Vol. PS-3, No. 4, pp 209-215
 (10/1975). 3 Refs.
- Primary Keywords: Homopolar Machines; Fast Discharge (5-30ms)
- COPYRIGHT: 1975 IEEE. REPRINTED WITH PERMISSION
- 3295
 (BREAKDOWN STUDIES)
 (Vacuum; Electrical)
HIGH VOLTAGE STATIC BREAKDOWN IN VACUUM
 A. Watson
 University of Western Ontario, London, Ontario, Canada
Canadian Journal Of Physics, Vol. 54, No. 2, pp 142-157 (01/1976).

A model of the vacuum breakdown mechanism, where a semiconducting layer on a cathode protrusion produces the prebreakdown current, is presented. An analysis is given of the creation of a virtual cathode and the accompanying electron reservoir, and of the growth of the space charge bubble at the anode. The interaction of the two regions, ion interaction with the electron reservoir, and instabilities in the model are also discussed. The calculated breakdown voltage for copper electrodes is found to agree well with the obtained experimental value. 15 Refs.

Primary Keywords: Uniform Field Breakdown; Electron Reservoir; Virtual Cathode; Anode Evaporation; Impact Ionization

COPYRIGHT: 1976 NATIONAL RESEARCH COUNCIL OF CANADA

3320
 (BREAKDOWN STUDIES; INSULATION; VACUUM)
 (Vacuum; Particles)
IN-SITU OBSERVATION OF MICROPARTICLES IN A VACUUM-INSULATED GAP USING A SCANNING ELECTRON MICROSCOPE
 G. D. Thorpe-Jones, K. D. Srivastava and R. G. Van Heeswijk
 University of Waterloo, Waterloo, Ontario, Canada
Journal of Applied Physics, Vol. 47, No. 3, pp 897-898 (03/1976).

Results are presented of an investigation into microparticle activity in a vacuum-insulated three-electrode gap. Measurements were conducted in situ using the combination of a scanning electron microscope (SEM) and a fine-microparticle counter at voltages well below breakdown. The most common size of the microparticles observed was 10 micrometers and very few particles above 10 micrometers were detected. 3 Refs.

Primary Keywords: Small-sized Microparticle; Medium Sized Microparticle; Large Microparticle; Microparticle Activity; Insulator Charging

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3327
 (SWITCHES; CLOSING)
 (Vacuum Gaps; Optical)
LASER-TRIGGERED VACUUM SWITCH
 V. S. Bulygin, V. B. Lebedev, G. A. Pravnikova, V. V. Ryukkert, S. S. Sitskashvili and V. A. Yakovlev
Soviet Physics-Technical Physics, Vol. 20, No. 4, pp 561-563 (04/1975).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 49, 892-897 (April 1975).

The conductivity of a two electrode vacuum gap is increased by the plasma produced by focusing laser light on the surface of one of the electrodes. The switching properties of a vacuum discharge initiated by the laser beam are determined. These studies are conducted over a wide range of gap voltages and for differing polarities of the target electrode. 3 Refs.

Primary Keywords: Vacuum Spark Gap; Electrode Laser Illumination; Surface Triggering; Delay Measurement; Jitter Measurement

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3328
 (PARTICLE BEAMS; ION)
 (Gas Discharge)
PLASMA-SURFACE SOURCE OF NEGATIVE IONS
 Yu. I. Boichenko, O. I. Dimov and V. G. Likhachev
 Institute Of Nuclear Physics, Academy Of Sciences Of The USSR,
 Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 43-47 (07/1975).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 47, 68-73 (January 1975).

A high-current pulsed source of negative ions that uses a planotron discharge is described. A H beam with a current density up to 3.7 A/cm² in the emission slit has been obtained from the discharge chamber as a result of the intense extraction of negative ions from the cathode surface, which is bombardment by fast particles from the discharge. The intensity of the extra fed ion beam is roughly proportional to the area of the emission slit. A negative ion beam with a current of 0.5-0.8 A has been obtained from source H. The beam current 0.5-1.0 mA in this case the electron current is less than 1.1 A. 5 Refs.

Primary Keywords: Hydrogen Ion; Planotron Discharge; I-A Ion Current; Cathode Bombardment By Particles

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3340
 (BREAKDOWN STUDIES)
 (Vacuum; Electrical)
PREBREAKDOWN PHENOMENA IN VACUUM WITH DIRECT AND ALTERNATING VOLTAGES AT ROOM AND CRYOGENIC TEMPERATURES
 P. N. Allan and P. K. Bordoli
 University of Manchester, Manchester, UK
Journal Of Physics D: Applied Physics, Vol. 8, No. 15, pp 2170-2180 (1/1975).

These investigations were conducted to measure the prebreakdown current and breakdown voltage between stainless steel electrodes using 50 Hz alternating and direct voltages. The measurements were made at room temperature and liquid nitrogen temperatures for a uniform field electrode. The range of peak breakdown currents for the current measurements was 0.1-0.5 mA and for the breakdown voltages was 0.1-0.8 kV. The variation of the peak breakdown current and breakdown voltage with temperature and electrode spacing was very similar for both types of voltage and current. Also with both types of voltage, the prebreakdown current obeyed a cold-cathode emission law, qualitatively similar to the Fowler-Halliday-T relation. In both cases an ambient pressure greater than about 1E-6 Torr caused the current to be suppressed, though this was found to be a reversible effect. 18 Refs.

Primary Keywords: Prebreakdown Current; Breakdown Voltage; Power Line Frequency; DC Voltage; Room Temperature; Liquid Nitrogen Temperature

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3352
 (BREAKDOWN STUDIES)
 (Gas; Electrical)
THEORETICAL BREAKDOWN OF LONG GAPS IN SULFUR HEXAFLUORIDE
 T. Nitta and T. Shioya
 Mitsubishi Electric Corp., Amagasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1046-1051 (06/1971). 26 Refs.

The electrical discharge characteristics of SF₆/sub 6/ are discussed theoretically in relation to the field dependence of the ionization coefficient, alpha and the electron attachment coefficient, etc. The results are compared with the characteristics of air. A simple theoretical formulation of breakdown or corona inception voltages of gaps in SF₆/sub 6/ is derived. The formulation has been examined by experiments on several electrode configurations. At low pressures of less than 4 atm, the agreement of the theoretical and the experimental results is fairly good. The breakdown voltage decreases from the theoretical estimation at higher pressure. 12 Refs.

Primary Keywords: SF₆/sub 6/; Theory; Breakdown; Corona; Analytical Solution; Ionization Coefficient; Attachment Coefficient; High Pressure; Comparison With Air

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

3362
 (SWITCHES; CLOSING)
 (Liquid Gaps; Self)
WATER SPARK GAP FOR A NITROGEN LASER
 S. Serken and F. Shimizu
 University of Tokyo, Bunkyo-ku, Tokyo, Japan
Review Of Scientific Instruments, Vol. 46, No. 12, pp. 1700-1701 (12/1975).

Satisfactory operation of the Blumlein type nitrogen laser was obtained by using a water-filled spark gap. The water-filled spark gap uses flowing water, and the Blumlein circuit is charged by a Marx-bank driver. 4 Refs.

Primary Keywords: Water Spark Gap; Blumlein Line; Fast Rise Time; Comparison With Air Gap; General Electrode Material

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3374
 (SWITCHES; CLOSING)
 (Gas Gaps; Electrical)
FAST AIR GAP CROWBAR SWITCH DECOUPLED BY A LOW PRESSURE GAP
 S. Kitayama and K. I. Hirano
 Nagoya University, Nagoya, Japan
 No. JPN-7-20, 26p (04/1976). Availability: N74-35138/AS1

N15

A fast pressurized crowbar gap switch, in which a low pressure gap is used as a nonlinear decoupler, is investigated. The switch is composed of a simple two-electrode high pressure gap and a low pressure gap of trigger-type. A special trigger circuit is designed in such that a single pulse breakdown of the high- and low-pressure gaps successively. The jitter of breakdown time is less than 20 nsec over the wide range of the operating conditions. Working voltage and pressure in both gaps. The switch is designed for 40 kV operation and its inductance is 22 nH. Seventy switches of this type are installed in a 40 kV, 210 kJ fast capacitor bank. Up to now they have been running successfully for 8000 shots with little maintenance. (Author)

Primary Keywords: Gaps; High Voltages; Switches; Trigger Circuits; Capacitors; Electric Switches; Plasma Pinch; Trigatron

Secondary Keywords: NIISNASA

3383
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Electrodes, Gas; Electrical)

INITIATION OF ELECTRODE EROSION AND OF THE CONDITIONS OF SPECTRUM EXCITATION WITH AN IMPULSIVE DISCHARGE IN A MAGNETIC FIELD

A. V. Kolegov, N. I. Strukov and A. V. Ulyanov
Journal of Applied Spectroscopy, Vol. 19, No. 2, pp 969-973 (08/1973).

Previous research investigated the entrance of electrode material into the cloud of a low-voltage impulsive discharge and established the time variation of the entrance of both the vapor and liquid phases of the erosion products. In the initial stage of the discharge, independently of the electrode's polarity, there was a predominant entrance of material in the most finely divided phase. The duration of this discharge stage was increased by mechanical displacement of a substitute electrode along the flat surface of the specimen. This permitted an enhancement of effectiveness in the use of material for obtaining a spectrum. In the present research, instead of mechanical displacement of a substitute electrode, the effect of the magnetic field on the discharge channel was replaced under the action of a magnetic field. The coil that created the magnetic field had an inductance of 20 microHenry and was connected in the discharge circuit in series with the interelectrode gap. The starting of the total discharge-cloud luminescence showed that brightly shining spots adjacent to an electrode are formed on the surface of the specm during the discharge. In the initial stage of the discharge, the shifting of the spots is smooth and continuous; with increase of current the spots shift in a jerky manner. The number of these spots is larger than that of the cathode spots. 2 Refs.

Primary Keywords: Gas Breakdown; Low Pressure Breakdown; Electrode Erosion; Magnetic Field; Electrode Spot Movement; Anode Spot; Cathode Spot.

COPYRIGHT: 1975 PLenum Press. REPRINTED WITH PERMISSION

3385
(LASER TRIGGERED SWITCHING OF A PULSED, CHARGED, OIL FILLED SPARK GAP)

A. L. Smith, G. J. English, J. R. Scott and R.P. Cramond
J.E. & R. 1973, No. 8717

Proc. of Scientific Instruments, Vol. 46, No. 7 pp 916-920 (07/1975). A focused Q-switched laser, aligned along the interelectrode axis of a pulsed charged spark assembly, was used to initiate the discharge which overcame the formed oil filled gap. Laser power was 100 mJ/pulse at 210 Hz and the voltage pulse repetition rate was 100 Hz. The authors report the first study of the factors affecting the delay between the laser pulse arrival at the gap and conduction of the gap. The effects of the focal point location, laser power, switch polarity, and voltage on the gap at laser arrival were determined. Delay times as short as 12 nsec were recorded with jitter, a measure of reproducibility, in the low nanosecond region. 13 Refs.

Primary Keywords: Laser Switching; Pulse Charged Dielectrics; Oil Dielectrics; Laser Triggered Marx Generator; Oil-filled Capacitors; Laser Induced Breakdown; Arc Discharge; Nanosecond Switching

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3390
(BREAKDOWN STUDIES)

(Gases, Electrical)

ON THE THEORY OF THE SPARK PLASMA IN NANOSECOND LIGHT SOURCES AND FAST SPARK-GAP SWITCHES

H. Hess
Akademie der Wissenschaften der DDR, Zentralinstitut Fur Elektrophysik, Berlin, DDR
Journal of Physics D: Applied Physics, Vol. 8, No. 6, pp 685-689 (04/1975).

In papers on nanosecond gas discharge light sources there has been no theoretical approach capable of describing the dependence of the half-width and the maximum power of the optical pulse on the many parameters which can be varied. On the basis of the theory of Weizel and Rompe (1967) extended to thermal plasmas, the author predicts at least the electric behaviour of the spark discharge in low-inductance circuits normally used for the generation of nanosecond light pulses. 13 Refs.

Primary Keywords: Spark Discharge; Theory; Thermal Plasma; Power Dissipated

Secondary Keywords: Optical Source

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3404
(SWITCHES, CLOSING)

(Gas Gaps; Optics)

APPLICATIONS OF A LASER-TRIGGERED SPARK GAP (LTSG)

T. Naguchi (1), M. Yang (2), T. Tsuchi (2) and K. Mori (2)

(1) Electrotechnical Lab., Tokyo, Japan

(2) Nagoya University, Nagoya, Japan

Electrical Engineering in Japan, Vol. 94, No. 2, pp 13-19 (03/1974).

Trans. from Denki Gakka Ronbunshi, Vol. 94, 121-128 (March 1974)

20 Refs.

Primary Keywords: Applications; Several Triggering Modes; Crowbar Switch; Master Trigger Gap

3418
(PARTICLE BEAMS; ELECTRON; PARTICLE BEAMS; ELECTRON)

(Transport; Target Interactions)

ELECTRON BEAM FOCUSING AND APPLICATION TO PULSED FUSION

G. Jones, J.W. Poukey, K.R. Prestwich, J.R. Freeman, A.J. Tsoi and M.J. Clauser
Sandia Labs, Albuquerque, NM 87115

Nuclear Fusion, Vol. 14, No. 5, pp 73-74 (11/1974).

Recent works on the focusing of high-current relativistic electron beams are reviewed and the physics of these beams is examined both empirically and through computer simulation. The distribution of the electron beam in space or research is discussed along with the interaction of the beam with the target and the beam requirements for breakdown. 49 Refs.

Primary Keywords: Relativistic Electron Beam; Beam Focusing; Vacuum Diode; Plasma Transport

Secondary Keywords: Inertial Confinement Fusion

COPYRIGHT: 1974 INTERNATIONAL ATOMIC ENERGY AGENCY

3423
(FEDER CONDITIONING)

(Pulse Transformers)

FOCUS ON PULSE TRANSFORMERS

Unknown

Electronic Design, Vol. 23, No. 13, pp 78-83 (06/1975).

A discussion of pulse transformers and their key parameters is given. Practical design techniques for designing systems with pulse transformers are presented with a special emphasis given to reading trace fabrication sheets. 0 Refs.

Primary Keywords: Characterization; Reading Specifications; Application Data; Design Considerations; Bibliography Of Supplies

COPYRIGHT: 1975 HAYDEN PUBLISHING CO., INC.

3426

(BREAKDOWN STUDIES)

(Plasma)

GAS LASER DISCHARGES IN CONTINUOUS METAL TUBES

A.L.S. Smith and M. Brooks
University of St. Andrews, St. Andrews, Fife, KY16 9SS, UK

Journal of Physics D: Applied Physics, Vol. 7, No. 16, pp 2455-2463 (12/1974)

4 Refs.

Primary Keywords: Current Distribution; Multi Segment Construction; Slow Discharge; Single Continuous Discharge; 10 μ sec Cavity; 2% Laser

COPYRIGHT: 1974 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3429

(PULSE GENERATORS)

(Transistors)

HIGH-SPEED SWITCH HANDLES 400-V PEAK AND IS CONTROLLED BY LOGIC LEVELS

S.D. Andrade
Micropower, MN 55417

Electronic Design, Vol. 23, No. 2, pp 74 (01/1975).

A circuit is presented that can switch 400 V at 100 kHz. Output voltage waveforms are given for switching rates of 1 kHz and 100 kHz (310 V into a 10 k ohm load). 0 Refs.

Primary Keywords: 100 V Voltage Range; Very High Rep-rate; Fast Rise; Isolated Switch

COPYRIGHT: 1975 HAYDEN PUBLISHING COMPANY

3452

(BREAKDOWN STUDIES)

(Electrodes)

INFLUENCE OF ELECTRODE COATINGS ON THE BREAKDOWN STRENGTH OF TRANSFORMER OIL

A.A. Zeky, M.E. Zain, Eldin and J. Newley

C.I.T. Parsons & Co. Ltd., Newcastle-upon-Tyne, UK

Nature, Vol. 202, pp 687-688 (05/1964).

The influence of coating one or both of the electrodes on the breakdown of transformer oil is studied. It is found that coating the electrodes with 'Penton' increases the initial breakdown voltage substantially. Coating either electrode is found to be as effective as coating both electrodes. 4 Refs.

Primary Keywords: Transformer Oil Breakdown; Electrode Coating; 'Penton'; One Electrode Coated; Both Electrodes Coated

COPYRIGHT: 1964 MACMILLAN AND CO., LTD.

3462

(MAGNETIC INSULATION)

()

COAXIAL HIGH-VOLTAGE DIODE WITH MAGNETIC INSULATION

V.S. Voronin and A.N. Lebedev

Academy of Sciences of the USSR, Moscow, USSR

Soviet Physics Technical Physics, Vol. 18, No. 12, pp 162-163 (10/1974).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 43, pp 2591-2598 (1974). A theory is derived for magnetic insulation in a relativistic coaxial diode. This theory is self-consistent in terms of the magnetic field (B-dot-diamagnetism) and the electrostatic field (space-charge limitation). The dependence of the relative magnetic field is found as a function of the diode parameters. The self-consistent equilibrium of a charged hollow beam in an external magnetic field is analyzed in the transport section. The conditions corresponding to maximum current are determined. 5 Refs.

Primary Keywords: Relativistic Coaxial Diode; Diamagnetism; Space-charge Limitation

COPYRIGHT: 1974 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3483

(INSULATION, VACUUM)

()

HIGH-VOLTAGE VACUUM INSULATION WITH EPOXY-COATED CATHODES

L. Jodvorky (1) and S.Y. Towles (2)

(1) University of Wisconsin, Madison, WI

(2) University of Tehran, Iran

Journal of Vacuum Science And Technology, Vol. 11, No. 1, pp 472-473 (02/1974).

The breakdown voltages for two electrode coating materials (C-26 epoxy and Mylsub 2') and uncoated electrodes in vacuum are compared for various gap spacings, ranging from 1 to 10 mm. The authors conclude that the breakdown voltage is dependent only on field strength and that the coatings have a significant effect on breakdown voltage and pre-breakdown current. 5 Refs.

Primary Keywords: Vacuum Insulation; Epoxy Coating; Breakdown Voltage; Pre-breakdown Current; Variable Gap Spacing

COPYRIGHT: 1974 THE AMERICAN VACUUM SOCIETY

**3552
(PARTICLE BEAMS; ELECTRON)**

GENERATION OF A HIGH-INTENSITY RELATIVISTIC ELECTRON FLUX
R.L. Parker, R.E. Anderson and C.V. Duncan
Rev. Sci. Inst. and App., Vol. 48, No. 6, pp. 2463-2479 (06/1974).

The results of a comprehensive diode study conducted using a pulsed high-current electron accelerator are reported. Time-dependent analysis of a high-current graphite cathode diodes has shown evidence of the field emission character of the cold-cathode diode. The effects of cathode whiskers or microprojections on the diode response have been observed, within a few nanoseconds after the voltage is applied to the diode, the whiskers expand to form cathode flares. The observed diode behavior throughout the remainder of the pulse can be explained in terms of the evolution of the initial cathode formed by the merger of many cathode flares. Cathode plasma injection ranges from approximately 10% to 30% of the current. The observed diode behavior was consistent with that predicted in previous studies of high-current vacuum breakdown. [3 Refs.]

Primary Keywords: Field Emission Diode; Graphite Cathode; E-beam Generation; Cathode Flare; Plasma Cathode; Diode Performance.

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION.

**3553
(BREAKDOWN STUDIES)**

INHERENT LIMITATIONS IN UNIFORM FIELD DISCHARGE DATA FOR SF₆/SUB 6/
P.W. Karlsson and A. Pedersen
The Technical University, Lyngby, Denmark
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 4, p. 1511 (07/1972).

Calculated uniform field discharge data for SF₆/sub 6/ may be subject to errors caused by the effect of the inherent nonuniformity of the test gap. It is shown that uniform field pre-breakdown measurements of ionization and attachment coefficients in SF₆/sub 6/ ratio to values below a few hundred mm/cm, and that pd must be less than 100 cm to obtain proper uniform field breakdown voltage. [1 Ref.]

Primary Keywords: Gas Breakdown; Uniform Fields; SF₆/sub 6/; Field Nonuniformities; Prebreakdown Current; Ionization Coefficient; Attachment Coefficient; Theory

COPYRIGHT: 1972 IEEE. REPRINTED WITH PERMISSION

**3554
(BREAKDOWN STUDIES)**

INCIPITATION OF ELECTRICAL BREAKDOWN OF LONG AIR GAPS
G.J. Jarvis, Jutter and B.A. Tozer
Metropolitan Engineering Lab., Southampton, UK
Journal Of Physics D: Applied Physics, Vol. 7, No. 2, pp. 383-388 (01/1974).

[4 Refs.]

Primary Keywords: Point To Plane Gap; Critical Charge Criterion
COPYRIGHT: 1974 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**3555
(INSULATION; MATERIAL; BREAKDOWN STUDIES)**

SOLID; SOLID; RADIATION
IONIZING RADIATION EFFECTS IN INSULATORS AND INSULATING PARTS
V.A.J. Van Lint and J.K. Harrity
Cult Energy And Environmental Systems, Inc., San Diego, CA
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp. 111-115 (09/1971).

The effects of ionizing radiation on insulator parts are discussed as being the results of four associated phenomena: conduction, charge transfer, space charge buildup, and air ionization. Techniques for estimating these effects under some circumstances of interest are described. [1 Refs.]

Primary Keywords: Ionizing Radiation; Conduction; Charge Transfer; Space Charge; Numerical Calculation

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

**3556
(BREAKDOWN STUDIES)**

EFFECT OF HUMIDITY ON SPARKOVER OF AIRGAPS UNDER IMPULSE VOLTAGES
E.J. Applebee and D. Dring
Leeds University, Leeds, UK
Proceedings Of The IEE, Vol. 121, No. 3, pp. 221-222 (03/1974).

Rod-rod and rod-plane gaps are utilized to study the effects of varying the humidity of 40 cm gap in a 5 cm/s carrier. Impulse voltages were applied at humidity ranging from 7.27 g/cm³. An approximately linear relation was found between humidity and breakdown voltage. [4 Refs.]

Primary Keywords: Air Gap; Rod-rod Gap; Rod-plane Gap; Impulse Voltage; 7.27 g/cm³; Humidity; Linear Relationship

COPYRIGHT: 1974 IEE

**3557
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES; CLOSING)**

(Gas; Electrical; Gas; Optical; Gas Gaps; Optical)
FORMATION AND GUIDING OF HIGH VELOCITY ELECTRICAL STREAMERS BY LASER INDUCED IONIZATION

D.W. Kosoprak and R.A. Sauer
Varian Inc., Springfield, VA 22141
Journal Of Applied Physics, Vol. 46, No. 12, pp. 5328-5336 (12/1973).
The electrical breakdown characteristics of long spark gaps have been measured by laser-induced ionization. The mean velocity of >500-eV streamers is increased by an order of magnitude, to approximately 300 cm/s², and discharge columns are guided over a straight path in air and other atmospheres, by a 1.06 micron optical beam focused to approximately 10⁻³ W/cm². Time-resolved studies of the experimental phenomena, together with theoretical models for the evolution of laser induced ionization, indicate that a continuous four-level ionization, rather than the occasional optical breakdown bands along the beam path, is responsible for the observed effects. Analysis of the discharge data and direct measurement of the ionization generated by laser radiation focused to subbreakdown intensities both confirm that positive and negative velocity densities in the range 10¹⁸ to 10¹⁹ cm⁻³ s⁻¹ are responsible for directed and unidirectional streamer propagation. Photoionization of air by the luminous discharges from cathode tip enhances the streamer propagation. 0.5 μm can also be used to generate previously reported optical influence on electrical breakdown. [12 Refs.]

Primary Keywords: High Intensity Laser; Streamer Propagation; Varour Gaps; Temporally Resolved Experiments; Theory; Continuous Ionization

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**3558
(ENERGY CONVERSION; THERMAL)**

(Liquids)
LOW INDUCTANCE, LOW IMPEDANCE MEGAWATT AVERAGE POWER LOAD
W.J. Wright
ECOM, Fort Monmouth, NJ 07703
Technical rep., No. DELEI-TR-78-27, 5p (11/1978).

Availability: AD-A264 824/65T

A compact, low inductance, one-half ohm, one megawatt average power resistive load has been developed to facilitate testing of the Marx thyatron. The flowing liquid electrolyte system uses the large thermal mass of a storage tank of electrolyte to store the energy which is dissipated through a heat exchanger after the high power rate. The electrolyte starting temperature, low rate and dissipate temperature rise determine the maximum average power into the load, the external and internal spacings and face uniformity determine the operating power and flow rate and storage volume and the required running time. The load assembly consists of two parallel glass pipes, 10.1 centimeters/cm² in diameter and 15.25 cm long. The active volume in each pipe is 6.35 cm long and is contained between electrodes 9.9 cm in diameter. The two sections of the load are electrically in parallel and flowing in series, passing both face connections at ground potential. The major problem was getting the internal flow pattern uniform to eliminate local boiling and arcing across the bubbles while keeping the pressure drop low and flow high. The calculated inductance of the load assembly is 11 nanohenrys(nH), and the structure lends itself to coaxial connectors which reduce the overall inductance still further. Material compatibility with the electrolyte will be discussed. [Author] discussed [Author]

Primary Keywords: Duty Loads; Electricity; Electrical Loads; Pulse Generators; Electrolytes; Bubbles; Electric Arcs; Boiling; Electrical Resistance; High Energy; High Current; Thyatrons

Secondary Keywords: Liquid Resistors; Burst Mode; NTISDDDXA

**3559
(BREAKDOWN STUDIES)**

(Gas; Optical)
OPTICAL FREQUENCY ELECTRICAL DISCHARGES IN GASES

R.W. Minch
Ford Motor Co., Dearborn, MI
Journal Of Applied Physics, Vol. 31, No. 1, pp. 252-254 (01/1960).

By focusing the output beam of a giant-pulse laser, electrical discharge phenomena have been observed in air. The purpose of this communication is to present data on breakdown for various gases and to show that the behavior can be predicted by an extension of microwave frequency discharge theory. As with other sparks, a brilliant flash is seen and a sharp sound is heard. The spark is presumably initiated at the focus but quickly grows to a volume several mm in length and 1 mm in diameter. [Ref.]

Primary Keywords: Laser; Several Gases; High Pressure; Volume Discharge; Focal Volume; Threshold Power

COPYRIGHT: 1960 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**3560
(DIAGNOSTICS AND INSTRUMENTATION)**

(Voltage)
THE MEASUREMENT OF SHORT-DURATION IMPULSE VOLTAGES
F.C. Creed and M.M.C. Collins
National Research Council, Ottawa, Ontario, Canada
IEEE Transactions On Communication And Electronics, Vol. 82, No. 69, pp. 671-676 (11/1963).

A description is given of a very-small-impulse voltage divider which is insulated by compressed gas. The divider was designed for the measurement of steep-front impulse waves, and its errors have been evaluated by the step-response method, using a pressurized sphere-gap. It was then used for measuring the volt-time curve of a sphere gap, and the results have been compared with those obtained by others. [9 Refs.]

Primary Keywords: Shielded Resistance Voltage Dividers; Design Considerations; Analysis; Step Response

COPYRIGHT: 1963 IEEE. REPRINTED WITH PERMISSION

**3561
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)**

(Corona; Electrodes)
CONTROL OF CORONA AND SPARKOVER OF COAXIAL SYSTEMS BY IRRADIATION
P.T. Waters and W.B. Stark
University of Wales Institute Of Science And Technology, Cathays Park, Cardiff, U.K.

Proceedings Of The IEE, Vol. 120, No. 4, pp. 519-522 (04/1973). The subject of this paper is the breakdown of coaxial systems with small inner conductor conductances (0.315 - 6 cm). The paper begins with a study of the corona and breakdown voltages with variation in the diameters of the inner conductor for DC and AC applied voltages up to 220 kV DC and 35 kV AC. The observation of the breakdown voltage and pre-breakdown corona is presented with probable causes for specific behavior given. The gap between conductors is then irradiated with beta particles to improve the glow discharge characteristics for larger inner conductor diameters. It is found that the breakdown voltage is indeed improved for larger diameter inner conductors due to the effect of glow discharge, which was not observed for large diameter without irradiation. [4 Refs.]

Primary Keywords: Corona; Breakdown; Coaxial Line; DC Voltage; AC Voltage; Beta Particles; Improved Breakdown Voltage

COPYRIGHT: 1973 IEE

**3562
(BREAKDOWN STUDIES)**

(Gas; Optical)
10⁻¹¹ M.I. OF ABSORBED CASES ON PREBREAKDOWN CURRENTS IN VACUUM
J.W. Boekholt
Fysisch Laboratorium Rijksuniversiteit Utrecht, The Netherlands
Journal Of Physics B: Applied Physics, Vol. 6, No. 12, pp. 1475-1485 (09/1973).

It is demonstrated that ions released from adsorbed layers on the anode by field-emission electrons change the emitting properties of a well-conditioned cathode. The current density at the anode is reduced by 10⁻¹¹ m.s⁻¹ as is the case for plane-parallel electrodes with the same high-voltage electrode. no change could be measured for point-emission electrodes for which the field-emission current density at the anode is much less than 10 A/cm². it is suggested that surface migration as a result of ion bombardment is responsible for the reduction in the emitting properties of the cathode. [10 Refs.]

Primary Keywords: Anion Effect; Adsorbed Cases; Cathode Effect;

COPYRIGHT: 1973 IEE. REPRINTED WITH PERMISSION

AND VACUUM. [Ref.] THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3587

(BREAKDOWN STUDIES; SWITCHES; CLOSING)

(Gas; Electrical; Gas Gaps; Optical)

INFLUENCE OF ILLUMINATION ON THE SPARKOVER OF SPHERE GAPS AND CROWN-DIODELINEAR GAPS STRESSED WITH IMPULSE VOLTAGES

T. Allibone and D. Dring, Leeds University, Leeds, UK

Proceedings of IEEE, Vol. 120, No. 7, pp 815-821 (07/1973).

The authors consider the effects of illumination of sphere-sphere gaps on breakdown characteristics. The effect of voltage polarity, pulse duration, sphere diameter, and gap spacing are studied with and without incident UV and gamma radiation to determine its effect. The authors attempt to determine the mechanism to determine the variability of fired starting spark gaps to be used in voltage monitors. There are several potential aspects of the experiments that would be useful to consider in spark gaps as switches. 15 Refs.

Primary Keywords: Spacings; Sphere Gaps; UV Irradiation; Gamma Irradiation; Variable Diameter; Variable Spacing; Variable Polarity; Breakdown Characteristics

COPYRIGHT: 1973 IEEE

3588

(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Electrodes; Vacuum; Electrical)

LIGHTENBERG FIGURES PRODUCED BY HIGH-VOLTAGE DISCHARGES IN VACUUM

D. Chapman

Massachusetts Institute of Technology, Cambridge, MA

IEEE Transactions On Electrical Insulation, Vol. EI-8, No. 3, pp 87-91 (10/1973).

The formation of Lichtenberg figures on aluminum and titanium electrodes covered by oxide and nitride layers while being exposed to high vacuum and 100-kV (rms) 60-Hz voltage is recorded. The observations were made in the course of research on high-voltage vacuum insulation for cryocables. The Lichtenberg figures have several technological implications. They provide evidence for the occurrence of 1) focused ion beams, and 2) tangential discharges in the adsorbed layer of gas on the vacuum side of dielectric coverings on metal conductors. As Lichtenberg figures can only be produced by fast high-voltage pulses, they prove that the discharge duration was short compared with the period of the 60-Hz voltage wave. 7 Refs.

Primary Keywords: Lichtenberg Figure; Aluminum Electrode; Titanium Electrode; High Voltage Pulse; Fast Pulse

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3596

(BREAKDOWN STUDIES)

(Vacuum; Potential)

HOLES DESIGN FOR ACCURATE ALIGNMENT OF HIGH VOLTAGE ELECTRODES ASSEMBLY

R. Salaman and K. Salmon

University of Sheffield, Sheffield, UK

Vacuum, Vol. 23, No. 1, pp 9-10 (01/1973).

A design is described which enables the accurate alignment of high voltage plane parallel electrodes used in an ultra-high vacuum assembly. The main features of this design are that it effectively overcomes the eccentricities which are present in both the glass-to-metal graded seal used in the housing envelope and in the linear motion actuator employed to vary the gap separation between the electrodes, as well as being relatively simple to fabricate. The present design has been successfully tested in two large chambers at applied voltages of up to 150 kV and at a background pressure of better than 10⁻⁹ Torr. 0 Refs.

Primary Keywords: Electrode Alignment; Parallel Plane Electrodes; Linear Field Predictions; Breakdown Chamber Design

COPYRIGHT: 1973 PERGAMON PRESS

3604

(BREAKDOWN STUDIES; SWITCHES; CLOSING)

(Gas; Optical; Gas Gaps; Optical)

TRIGGERING MECHANISM OF A LASER-TRIGGERED SPARK GAP

T. Naguchi (1), M. Yano (1), T. Shimomura (1) and K. Horii (2)

(1) Electrotechnical Lab., Tokyo, Japan

(2) Nagoya University, Nagoya, Japan

Electrical Engineering In Japan, Vol. 92-A, No. 5, pp 27-34 (10/1972). Trans. From: Denki Gakkaishi, 92A, 449-456 (October 1972).

There has been an urgent need to develop impulse voltage and large current sources which satisfies the development of high-speed switches. We have investigated the triggering mechanism of the laser-triggered spark gap (LTS) for use as a high-speed switch. The LTS is a switch which initiates the breakdown of the gap by generating a laser spark in the gap with an applied voltage lower than the self-breakdown voltage. 18 Refs.

Primary Keywords: Breakdown Mechanism; High Energy Concentration;

Delayed Breakdown; Double Current Pulse; Delay

Breakdown

COPYRIGHT: 1973 IEEE

3627

(POWER TRANSMISSION)

(Cable; P.v.s.)

ADVANCED APPLICATION REPORT HIGH VOLTAGE XLPE INSULATED POWER CABLE

WITH SEMI-CONDUCTING ORGANIC LIQUID

T. Shibata, H. Matsuba, K. Nakano and T. Tanabe

The Furukawa Electric Co. Ltd., Tokyo, Japan

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 5, pp 1931-1940 (10/1972).

In our previous paper we reported our fundamental study and, to some extent, application to cables of the semi-conductive organic liquid which when laid in cross-linked polyethylene insulation for cables, deposits on the surfaces of voids in the insulation or between the insulation and the armature wire layer with the lapse of time and thus about a remarkable reduction in surface resistivity thereof. This is helping the electric field within cables to elicitizing partial discharges. Furthermore, the voltage-time characteristic curve of the cable with such insulation is quite hot control as compared with that of conventional cross-linked polyethylene insulated cable. We have since continued our study on such semi-conductive organic liquid in the process of its application to cable insulation and therefore is stable with very little deviation. The cable insulation containing the semi-conductive organic liquid has higher insulation breakdown voltage and free from breakdown at low voltage. We also found that its AC voltage breakdown voltage due not to freezing but to thermal breakdown caused by sharp increase in tan (sigma) near the breakdown voltage. 19 Refs.

Primary Keywords: Cable Insulation; Semi-conducting Organic Liquid; Partial Discharge; Partial Discharge Parameter

COPYRIGHT: 1972 IEEE. REPRINTED WITH PERMISSION

3609

(BREAKDOWN STUDIES)

(Gas; Electrical)

BREAKDOWN CHARACTERISTICS OF HIGHLY NON-LINEAR LONG GAPS IN COMPRESSED AIR

T. Takuma, T. Watanabe and K. Kita

Central Research Institute of the Electric Power Industry, Tokyo, Japan

Proceedings Of The IEE, Vol. 119, No. 12, pp 1767-1768 (12/1972).

The authors present data on the breakdown voltage of long (50 cm) compressed air gap. A rectangular geometry is used with a square rod utilized. Both polarities are considered with a range of pressures and gap spacings used. Both breakdown voltage and delay data are presented. 0 Refs.

Primary Keywords: Compressed Air Gap; 50 cm Gap; Rod-plane Gap; Square

COPYRIGHT: 1972 IEE

3615

(PULSE GENERATORS)

(Trigger)

PULSE BREAKDOWN VOLTAGE WITH CASCODED TRANSISTORS

P. T. Uhler, Air Force Base, Midwest City, OK

Transactions, Vol. 66, No. 1, pp 182 (01/1973).

A method of protecting bipolar transistors when placed in series in power-circuit applications is discussed. The breakdown voltage of the transistors is doubled without the use of costly high-voltage zener diodes by taking a cascade switch approach. 2 Refs.

Primary Keywords: Saturating Cascade Switch; Transistor; Saturator;

Charge-storage Transistor; Suppression

COPYRIGHT: 1973 McGRAW-HILL PUBLICATIONS

3617

(BREAKDOWN STUDIES)

(Gas; Electrical)

ELECTRICAL BREAKDOWN AND THE SIMILARITY LAW IN SF₆/SUB 6% AT EXTRA-HIGH-VOLTAGES

I.M. Bortnik (1) and C.M. Cook (2)

(1) All-Union Institute, Moscow, USSR

(2) Massachusetts Institute of Technology, Cambridge, MA

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 5, pp 2194-2203 (10/1972).

The DC electrical breakdown of SF₆/sub 6% gas at extra-high-voltages was studied experimentally in coaxial systems of moderate size. The results were compared to a similarity relationship of electric stress for breakdown based on ionization of the gas. For laboratory nuclear systems, theory and experiment agree when the macroscopic gradient does not exceed 150 to 200 kV/cm. If the active area of the stressed electrode is small the law remains accurate for higher gradients. Departures from the law are qualitatively explained by including the electrode surface microstructure in its application. 20 Refs.

Primary Keywords: SF₆/sub 6%; DC Breakdown in Sulfurhexafluoride; Coaxial System; Similarity Law; Experiment; Theory; Electrode Surface Structure

COPYRIGHT: 1972 IEEE. REPRINTED WITH PERMISSION

3623

(INSULATION; VACUUM)

(1)

HIGH-VOLTAGE CONDITIONING AT LARGE GAPS IN INDUSTRIAL VACUUM

G.F. Steib (1) and F. Mail (2)

(1) CEA Centre d'Etudes Nucléaires, Saclay, France 91260

(2) Institut Max von Laue-Paul Langevin, France

Journal Of Physics D: Applied Physics, Vol. 6, No. 2, pp 243-255 (01/1973).

The improvement of high-voltage insulation in vacuum by ageing the electrodes is well known. This so-called conditioning effect becomes very important in ultra-high-vacuum techniques cannot be employed in systems with large electrodes. For this reason the effect allows one to increase the initial field strength by a factor of about 12. In the present paper, the electrode gaps were varied between 15 and 30 cm. For such gaps, the conditioning and also the deconditioning process which occurs when the high voltage is removed have been studied. An attempt has been made to describe these processes mathematically, and to understand the mechanism involved. The results are compatible with the hypothesis that these effects are due to a change in the adsorbed gas layer, that is, a change in the work function of the electrode material. 26 Refs.

Primary Keywords: Vacuum Insulation; Conditioning; Breakdown Voltage; Increase; Decreasing; Experiment; Theory; Modeling

COPYRIGHT: 1973 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3626

(BREAKDOWN STUDIES)

(Gas; Electrical)

IMPULSE BREAKDOWN OF LARGE SPHERE-PLANE GAPS

J.Y. Herzer, R.C. Kleve and B.A. Teller

Marshall Space Flight Center, Huntsville, AL

Proceedings Of The IEE, Vol. 119, No. 12, pp 1751-1753 (12/1972).

The authors present a comparison of sphere-plane and rectangle-plane gaps with large electrodes. For each gap size the effect allows one to increase the initial field strength by a factor of about 12. In the present paper, the electrode gaps were varied between 15 and 30 cm. For such gaps, the conditioning and also the deconditioning process which occurs when the high voltage is removed have been studied. An attempt has been made to describe these processes mathematically, and to understand the mechanism involved. The results are compatible with the hypothesis that these effects are due to a change in the adsorbed gas layer, that is, a change in the work function of the electrode material. 26 Refs.

Primary Keywords: Large Air Gap; Sphere-plane Gap; Rod-plane Gap; Air

Breakdown; Impulse; Current Resolution

COPYRIGHT: 1972 IEE

3631

(BREAKDOWN STUDIES)

(Gas; Electrical)

MEASUREMENT OF THE ENERGY RELEASED IN NANOSECOND ELECTRIC SPARKS

L. Johansson, K. Strid and S.R. Johansson

Swedish Match Co, Jönköping, Sweden

Combustion Science And Technology, Vol. 5, pp 1-6 (01/1972).

The energy released in a spark is studied by the authors. A pulse travelling down a transmission line is used to initiate a spark. The energy reflected back down the transmission line is analyzed to infer the energy dissipated in the spark. A method of calculating the energy is presented. 6 Refs.

Primary Keywords: Spark Breakdown; Energy Dissipation; Transmission Line; Reflected Energy; Analytical Calculation

COPYRIGHT: 1972 GORDON AND BREACH, LTD./INTERSCIENCE PUBLISHERS, LTD.

**3633
(INSULATION, MATERIAL)
(Solid)**

MECHANISM OF SURFACE CHARGING OF HIGH-VOLTAGE INSULATORS IN VACUUM
C.M. De Tournail and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-8, No. 1, pp 17-21
(03/1973).

In vacuum, the surface of insulators becomes electrically charged when subjected to high-voltage stresses. The charging mechanism is described. A model simulating the charging shows that the surface charge densities are proportional to the applied voltage and depend on the secondary electron emission of the insulator surface. It is also time dependent. Surface charges are shown to explain many results obtained in studies of insulator surface breakdown. 10 Refs.
Primary Keywords: Insulator Charging; Secondary Emission; Incidence Angle; Simulation; Numerical Calculation

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

**3634
(BREAKDOWN STUDIES)
(Gas, Electrical)**

HANDECOND BREAKDOWN IN HEXANE

J.A. Bell, R.R. Rogers and A.H. Guenther
AFWL, Kirtland AFB, NM 87117
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 2, pp 78-83
(06/1972).

The electrical breakdown of hexane was investigated using nanosecond duration high-voltage pulses. An attempt was made to experimentally isolate the formative time lag contributions of the two major breakdown mechanisms, electron avalanche and streamer processes. The electrode areas were kept constant at 2.85 sq.cm. throughout the study and the resulting breakdown times were 0.5 ns. The gap spacing and the applied field were varied in a highly controlled manner. A series of breakdown events were studied for gap spacings ranging from 0.07 to 0.41 cm with selected constant field strengths from 0.8 to 1.6 MV/cm. The results obtained indicate that the streamer mechanism is the dominant process in the breakdown of hexane and the average velocity of propagation is on the order of 1E7 cm/s for the fields and gap spacings used in this study. 20 Refs.
Primary Keywords: Formative Time Lag; Avalanche; Streamer; Very High Field Strength

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**3635
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)**

OPTICAL KERR CONSTANT MEASUREMENT IN SOME LIQUIDS AND GLASSES
B. Lacour and J.P. Pocholle
Centre de Recherches, Compagnie Generale d'Electricite, Marcoussis, France
IEEE Journal of Quantum Electronics, Vol. QE-8, No. 5, pp 456-457
(05/1972).

We have measured the optical Kerr constant of two glasses and two liquids, namely phosphoryl chloride and toluene. We find that the nonlinear indices n/sub 2/ are of same order of magnitude in glass and phosphoryl chloride. 7 Refs.
Primary Keywords: Kerr Constant; Phosphoryl Chloride; Toluene; Two Glasses; Glass Laser; 95 Deg. Incident Polarization

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**3636
(BREAKDOWN STUDIES)
(Liquid, Electrical)**

PREBREAKDOWN PROCESSES IN ELECTRICALLY STRESSED INSULATING LIQUIDS
B. Singh, W.G. Chadband, C.W. Smith and J.H. Calderwood
University of Salford, Salford, UK
Journal of Physics D: Applied Physics, Vol. 5, No. 8, pp 1457-1464
(08/1972).

It has previously been reported that a spray originates from high-voltage point electrodes in n-hexane. This paper is concerned with more detailed investigation of that spray. Although it is more readily observed if the point electrode is negative, it can also be seen when the point is positive provided that the gap length is adequate. The distribution of spray in the gap of a point-plane system is approximately conical. The apex of the cone is about 60 Deg. for a negative point and 120 deg. for a positive point. The spray appears to consist of bubbles which cross the gap with a velocity of the order of metres per second, and which have grown to become about 15 microns in diameter by the time they reach the plane electrode. Their size at the point electrode is not directly measurable but has been found to be an order of magnitude less by light-scattering measurements. The onset of the spray coincides with the appearance of corona at the tip of the point electrode, and the spray onset voltage is a function of the radius of the electrode tip. An account is given of some of the complex processes which seem to govern breakdown processes in insulating liquids. 23 Refs.
Primary Keywords: Prebreakdown Current; N-hexane; Point Electrode; N-hexane Spray; Cathode; Corona

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**3639
(DIAGNOSTICS AND INSTRUMENTATION)**

PRECISION CAPACITIVE VOLTAGE DIVIDER FOR IMPULSE VOLTAGE MEASUREMENTS
A.J. Schwabb and J.H.W. Page
University of Karlsruhe, Karlsruhe, FRG
IEEE Transactions On Power Apparatus And Systems, Vol. 91, No. 6, pp 2376-2382 (12/1972).

This paper describes a precision capacitive voltage divider for impulse voltage measurements. The main feature of the new divider is a compressed-gas capacitor in the high-voltage arm. The divider is insensitive to environmental influences, possesses outstanding high-frequency properties, and causes little loading of the high-voltage circuit. Its excellent linearity and stable ratio permit meaningful high-voltage pulse measurements in the megavolt range. 14 Refs.

Primary Keywords: Capacitive Voltage Divider; Compressed Gas Capacitor; Good Linearity; Megavolt Voltages

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**3641
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)**

RECENT REFINEMENTS AND DEVELOPMENTS IN KERR SYSTEM ELECTRICAL MEASUREMENT TECHNIQUES

E.C. Cassidy (1), W.E. Anderson (1) and S.R. Booker (2)
(1) National Bureau of Standards, Washington, DC 20234
(2) Sandia Labs, Albuquerque, NM 87115

IEEE Transactions On Instrumentation And Measurement, Vol. IM-21, No. 4, pp 504-510 (11/1972).

Kerr system electrical measurement techniques are improved by progress in two important areas: 1) in the development of methods for visualizing and measuring pulsed (microsecond) electric fields and high voltages from time-varying electrooptical fringe patterns recorded using high-speed photographic techniques, and 2) in the development of convenient experimental methods for evaluating and correcting the high-order aberrations in Kerr systems. Results demonstrate use of fringe-pattern measurements in achieving accurate pulse voltage measurements and in correction of errors resulting from sizeable end-field variations in existing 300-kV Kerr cells. 4 Refs.
Primary Keywords: Kerr Effect; Electric Field Measurement; Error Analysis; Error Correction; Streak Camera

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**3644
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical)**

SPARK GAPS CAN SWITCH AS WELL AS PROTECT

M. Di Stefano
General Instrument Corp., Neptune, NJ
Electronics, Vol. 45, No. 15, pp 94-95 (07/1972).

Possible applications of the spark gap as a high-energy, voltage-sensitive switch are discussed. Considered are load protection circuits, flash tube triggering circuits, crowbar protection circuits, and high voltage Marx generators. Important parameters and characteristics of the spark gap are examined. 0 Refs.
Primary Keywords: Low Voltage; Arc Mode; Short Duty; Triggered Spark Gap; Self-breaking Spark Gap

COPYRIGHT: 1972 McGRAW-HILL INC.

**3646
(SWITCHES, CLOSING)**

(Gas Gaps, Electrical)

SPECIAL SPARK-GAP SWITCHES FOR USE IN SYNTHETIC TEST CIRCUITS
N.S. Ellis, W.T. Lugton, C.W. Powell and H.M. Ryan
A. Rayville & Co. Ltd., Hebburn, County Durham, UK
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 5, pp 2024-2025 (10/1972).

A technology concerned with proving the performance of modern high-power circuit-breakers, special spark-gap switches have been developed to meet the specific requirements of 'break' and 'make-break' synthetic circuits, the former operating up to equivalent three-phase test levels of 30 G.V.A. This paper describes the design, performance characteristics and operating experiences for two types of specialized triggered switches incorporated in the Synthetic test circuits of the Rayville Short-Circuit Testing Station. 6 Refs.
Primary Keywords: Plasma-jet Trigger; Spinner Electrode Switch; Large Voltage Range; High Reliability; Air Blast Gaps

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**3647
(DIAGNOSTICS AND INSTRUMENTATION)**

(Voltage)

SUBNANOSECOND HIGH VOLTAGE ATTENUATOR

H.D. Sutphin
Los Alamos National Labs, Los Alamos, NM 87545
Review Of Scientific Instruments, Vol. 43, No. 10, pp 1535-1536
(10/1972).

A high voltage attenuator has been developed and tested that is capable of maintaining pulse rise times of less than 300 psec. Pulse amplitudes to 5 kV may be attenuated by a factor of 16, allowing the use of high speed, lower voltage commercial attenuators for reduction of the pulse to oscilloscope levels. The mechanical and electrical design maintains an impedance of 50 ohm. 2 Refs.

Primary Keywords: Resistive Voltage; Coaxial Configuration; Compensated; Subnanosecond Rise Time

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**3648
(SWITCHES, CLOSING)**

(Gas Gaps, Optical)

SWITCHING JITTER IN SPARK GAP TRIGGERED BY A TEM/SUB 005-MODE MODE-LOCKED RUBY LASER

D. Milam, C.C. Gallagher, R.A. Bradbury and E.S. Bliss
AFCRRL, Bedford, MA 01730
The Review Of Scientific Instruments, Vol. 43, No. 10, pp 1482-1484
(10/1972).

The first study of jitter in a laser triggered spark gap switched by pulse trains from a mode-locked ruby laser is described. The spark gap was fired by producing gas breakdown in a high pressure argon-nitrogen mixture between the pole pieces. Jitter was measured as a function of the position of the lens used to focus the laser beam and as a function of the ratio of the applied voltage to the self-breakdown voltage of the gap. Jitter values of less than 2 nsec were obtained under optimum conditions provided that the gap was fired by the early part of the pulse train. 10 Refs.
Primary Keywords: Ruby Laser; Argon-nitrogen Gap; Focal Plane Position Variation; Applied Voltage Variation; Jitter Measurement

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS

3649
(INSULATION, MATERIAL)

(1) SYNTHETIC PAPER FOR EXTRA HIGH VOLTAGE CABLE
T. Yamamoto, S. Iashiki, and S. Nakayama
The Fujiokura Cable Works, Ltd.
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 6, pp 2415-2426 (12/1971).

Extra high OF cables insulated by synthetic paper exclusively made of synthetic polymer were developed. It has been proved that the synthetic paper, given a structure similar to conventional paper, showed more favorable electric and physical characteristics and oil resistance, thus solving problems of extra high OF cables using films for insulation. This improvement is due to a structure having minute pores. This report develops considerations on this point. Trial OF cables with the synthetic paper for insulation were produced and tested on their characteristics; the measured results were satisfactory. Heating tests by loading power were conducted on its model samples. The test results showed that the synthetic paper is superior over the kraft paper as the insulator because of better heat resistance of its component polymers. 9 Refs.

Primary Keywords: Synthetic Kraft Paper; Artificial Fiber; Polymer Material

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

3656
(POWER CONDITIONING)
(Pulse Forming Lines)

A TRANSMISSION LINE CIRCUIT FOR RELIABLE SPARK GAP OPERATION
C. L. M. Ireland
University College of Swansea, Singleton Park, Swansea, Wales
The Review Of Scientific Instruments, Vol. 43, No. 9, pp 1378-1379 (09/1972).

The common transmission line circuits employed to enable a fast laser triggered spark gap to switch an optical cell are discussed. A modification is suggested that leads to a more reliable operation of the gap. 5 Refs.

Primary Keywords: Laser Triggered Spark Gap; Two Circuits; Pulse Shaping

Secondary Keywords: Laser Light Pulse Shaping

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3676
(BREAKDOWN STUDIES)

(Gas, Electrical)

INFLUENCE OF CORONA DISCHARGES ON THE BREAKDOWN VOLTAGE OF AIRGAPS

K. Feuer
Haefely Ltd., Basel, Switzerland
Proceedings Of The IEE, Vol. 118, No. 9, pp 1309-1313 (09/1971).
The authors consider the role of corona in the variation of breakdown voltage in rod-rod and rod-plane air gaps. The breakdown characteristics for several gap spacings are observed, along with the pre-discharge corona in each case. An attempt is made to separate the contribution of corona to breakdown for several waveshapes of both polarities. 20 Refs.

Primary Keywords: Breakdown Voltage; Rod-rod Gap; Rod-plane Gap;

Pre-breakdown Corona; Effect On Breakdown

COPYRIGHT: 1971 IEE

3686
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

PULSED LASER KERR SYSTEM POLARIMETER FOR ELECTRO-OPTICAL FRINGE PATTERN MEASUREMENT OF TRANSIENT ELECTRICAL PARAMETERS

E.C. Cassidy
National Bureau of Standards, Washington, DC 20234
The Review Of Scientific Instruments, Vol. 43, No. 6, pp 886-893 (06/1972).

Novel electro-optical fringe pattern methods are developed for measurement of transient high voltages and electric fields. Several techniques employing the Kerr effect, a pulsed laser source, and high speed photographic recording equipment are described. Typical fringe pattern results are compared with conventional resistive divider measurements. 13 Refs.

Primary Keywords: Pulse Voltage Measurement; Kerr Effect; Crossed Polarizers

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3688
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Vacuum, Electrical; Vacuum, Magnetic Field)

REDUCTION OF SPARKING VOLTAGES DUE TO A MAGNETIC FIELD PARALLEL TO THE AXIS OF POD ELECTRODES

M. J. Rofoofi and H.V. Cleve
Boeing Aerospace Co., Seattle, WA 98124
Journal Of Applied Physics, Vol. 42, No. 13, pp. 5392-5394 (12/1971).
Round-rod electrodes with flat ends were aligned with the axis of a gas-filled vacuum chamber. They were completely insulated by close-fitting glass except for the 1.0-cm-diam ends which faced each other to form a 2.5-cm-long spark gap. Sparkover voltage tests were made at 5 and/or 40 micron in Ar, Ne, He, N₂H₂, and air. An unexpected dramatic and sudden decrease in sparkover voltage occurred in all gases when modest steady uniform magnetic field was applied parallel to the axis of the electrodes. 4 Refs.

Primary Keywords: Breakdown Voltage Reduction; Parallel Magnetic Field

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3689
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

RESISTOR DIVIDER WITH DIVIDING ELEMENT ON HIGH VOLTAGE SIDE FOR IMPULSE VOLTAGE MEASUREMENTS

T. Harada (1), Y. Aoshima (1) and T. Imai (2)
(1) Central Research Institute of the Electric Power Industry, Tokyo, Japan

(2) Shikoku Electric Power Co., Takamatsu, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1407-1414 (06/1971).

The response characteristics of a resistor divider with dividing element on high voltage side were investigated theoretically and experimentally. As the results, it was revealed that it could be realized a divider having an excellent response characteristic by this method. 3 Refs.

Primary Keywords: Resistive Divider; Floating Ground; Stray Capacitance; Experiment; Theory

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

3691
(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)

(Gas, Electrical; Magnetism)

SPECTROSCOPIC INVESTIGATION OF THE SPARK CHANNEL

M.M. Kekez, M.R. Barraud and J.D. Craggs

University of Liverpool, Liverpool, UK

Journal Of Applied Physics, Vol. 51, pp 253-265 (07/1971).

The different processes involved during the formation of spark discharges in hydrogen have been studied by the use of a spectrophotographic method. The voltage collapse across the gap during what is described as the second glow phase has been computed for a simple model, and good agreement between this and experimental results was found over a wide range of the experimental conditions. 19 Refs.

Primary Keywords: Spark Channel; Voltage Fall; Formative Time Log; Experiment; Theory

COPYRIGHT: 1972 JOURNAL OF APPLIED PHYSICS, REPRINTED WITH PERMISSION

3698
(SWITCHES, CLOSING)

(Gas Gaps, Materials)

ENERGY DISSIPATION AND ELECTRODE EROSION IN ARCS

H.G. Heard
Levinthal Electronic Products, Inc., Palo Alto, CA

Interim Report Prepared Under AFRC Contract No. AF 19(604)-1856

(10/1956).

Availability: AD 117051

NITS

A survey is made of the mechanisms of energy dissipation and electrode erosion in the DC and in the transient arc discharge at atmospheric pressure and in high vacuum. Loss of electrode material is shown to be due to electrochemical and electrokinetic processes. The scope of the report is confined to electrochemical and electrokinetic processes. It is concluded that erosion from the anode is due to evaporation whereas erosion from the cathode may be due to direct sublimation as well as evaporation. It is proposed that the onset of electrode erosion is governed by the thermodynamics of the evaporation process. This model predicts that electrode erosion is a threshold phenomenon. Appreciable erosion is expected only when the mechanism of the electric arc produces net energy in excess of the heat of vaporization of the material. If the net energy released at the rate of erosion is less than this value, the model predicts negligible erosion. Recommendations are included which are expected to reduce the rate of erosion in a spark gap. If the erosion rate cannot be reduced, the useful life of the spark gap may be extended by methods outlined herein. 98 Refs.

Primary Keywords: Electrode Erosion; DC Arc; Impulse Arc; Electrochemical Process; Electrokinetic Process; Evaporation; Sublimation; Electrode Life Extension

3699
(SWITCHES, CLOSING; BREAKDOWN STUDIES)

(Vacuum Gaps, Self; Vacuum, Electrical)

AC (50 Hz) AND DC ELECTRICAL BREAKDOWN OF VACUUM GAPS AND WITH VARIATION OF AIR PRESSURE IN THE RANGE 1E-9-1E-2 TORR USING OFMC COPPER, NICKEL, ALUMINUM, AND NIOBIUM PARALLEL PLANAR ELECTRODES

R. Hackam and L. Altschul

University of Sheffield, Sheffield, UK

Journal Of Applied Physics, Vol. 46, No. 2 (05/1974).

Breakdown potentials of vacuum gaps are measured over a wide range of air pressure using both AC and alternating applied voltage and employing four types of electrode materials. The air pressure is varied in the range 2E-9 - 2.5E-2 Torr for DC and 6E-7 - 2.5E-2 Torr for AC applied voltage. OFMC copper, nickel, aluminum, and niobium are used to fabricate the electrodes. It is found that the peak AC breakdown voltage is usually higher than the DC voltage for a fixed electrode separation and a fixed gas pressure. Under certain conditions considerable improvement in the insulating property of the gap can be obtained in semivacuum. The improvement in the breakdown voltage of the gap is considerable and can reach up to 62% in some cases. The higher breakdown voltage is attributed to the increased work function of the metal-gas adsorbate system. 62 Refs.

Primary Keywords: Vacuum Gap; Breakdown; DC Breakdown; AC Breakdown; Several Electrode Materials; Variable Electrode Separation

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3700
(BREAKDOWN STUDIES)

(Lightning)

ARTIFICIAL INITIATION OF LIGHTNING DISCHARGES

M. Brook (1), G. Armstrong (2), R.P.H. Winder (3), B. Vonnegut (4) and C.B. Moore (6)

(1) New Mexico Institute of Mining and Technology, Socorro, NM

(2) Museum Of Science, Boston, MA

(3) Office Of Naval Research, Boston, MA

(4) Weather Little, Inc., Cambridge, MA

(5) Journal Of Geophysical Research, Vol. 66, No. 11 pp. 3967-3969 (11/1961).

It was found that small currents of several milliamperes flow through a wire suspended beneath a storm creating an electric field that shields it from the lightning. Experiments were then performed in which a rapidly introduced wire caused a discharge from a Van de Graaf generator. The authors then theorized that a wire introduced rapidly beneath a storm might artificially cause a discharge. 2 Refs.

Primary Keywords: Lightning Initiation; Space Charge Neutralization; Plasma Wire

Secondary Keywords: Rockets

COPYRIGHT: 1961 AMERICAN GEOPHYSICAL UNION

3701
(INSULATION, MATERIAL; BREAKDOWN STUDIES)

(Solid; Vacuum, Electrical)

AUTOMATED PARTIAL-DISCHARGE TESTING OF TRAVELING-WAVE TUBES

K.W. Parchen and F. Haig

Aerospace Corp., El Segundo, CA 90245

AFSC Report No. SD-TP-81-38 (05/1981).

Availability: AD A099379

NITS

A test system is described that is used in the Materials Sciences Laboratory to evaluate the quality of high-voltage insulation in traveling-wave tubes. Evaluation is performed by quantitatively recording the occurrence of partial discharges during temperature cycling in vacuum for extended periods of time.

Primary Keywords: Corona; High-Voltage Test; Partial Discharge

Secondary Keywords: Automation; Traveling-Wave Tubes

3702
(PULSE GENERATORS; ENERGY STORAGE)
(Systems; Systems)

CONCEPTS STUDY FOR NANOSECOND RISETIME MULTI-MEGAJOULE IMPULSE POWER SYSTEMS

D. Holder
Army Missile Command, Redstone Arsenal, AL 35809
Technical Report No. RG-75-52 (06/1975).
Availability: AD A014985
NTIS

This report considers the concepts, techniques, and limitations of means for controlling the flow of extremely high electric currents and the production of very rapid rates of change of current through a load. Circuit-opening, and circuit-closing switches as well as a combination of the two for switching a source into a load are considered. 14 Refs.

Primary Keywords: Closing Switches; Opening Switches; Exploding Wire; Restrike; Spark Gap; Resistive Plasma; Capacitive Energy Storage; Inductive Energy Storage

Secondary Keywords: Crossed-field Switch

3703
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

CONCEPTUAL ENGINEERING DESIGN OF A ONE-GJ FAST DISCHARGING HOMOPOLAR MACHINE FOR THE REFERENCE THETA-PINCH FUSION REACTOR

K.I. Thomassen
Los Alamos National Labs, Los Alamos, NM 87545
EPRI Report No. EPRI ER-246 (08/1976).
Availability: EPRI ER-246

The design of a fast discharging homopolar machine (30 ms) storing 1.3 GJ of energy is described. Electrical, mechanical, and thermal considerations are included. The machine is designed to operate reversibly into an inductive load, with a 95% cycle efficiency. Other fusion applications of this type of machine are also described. 43 Refs.

Primary Keywords: Design Considerations; High Efficiency; Applications

COPYRIGHT: 1976 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

3704
(POWER CONDITIONING)
(Pulse Transformers)

DEVELOPMENT OF A 3 MV PULSE TRANSFORMER

G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND79-0813 (05/1979).
Availability: SAND79-0813
NTIS

This report describes a 3 MV transformer designed for charging high voltage pulse forming transmission lines. The transformer is an air core spiral strip design which incorporates ring cage shielding to control edge breakdown in the secondary winding. The physical features of the transformer are described along with its electrical characteristics and the operational results. 8 Refs.

Primary Keywords: Pulse Transformer; Pulse Forming Network; Small Size; Multimegavolt

Secondary Keywords: Capacitor Banks; Spark Gap

3705
(SWITCHES, CLOSING; BREAKDOWN STUDIES)

(Vacuum Gaps, Self; Vacuum, Electrical)

EFFECTS OF ELECTRODE CURVATURE, DISTANCE FROM GLASS INSULATOR, AND ADDITION OF HYDROGEN ON FIELD EMISSION CURRENTS AND BREAKDOWN VOLTAGE IN VACUUM

R. Hackem and S.K. Selman
University of Sheffield, Sheffield, UK
Journal of Applied Physics, Vol. 45, No. 10 pp 4384-4392 (10/1974).

Measurements of the prebreakdown currents have been made for highly polished stainless-steel electrodes in an ultrahigh vacuum at 1E-9 Torr as a function of electrode separation in the range 0.5-3.81 mm. Three sets of electrodes are employed to investigate the dependence of the prebreakdown current on the radius of curvature of the electrodes and the electrodes-insulator distance. The breakdown potential is measured in UHV gaps over the gap length range 0.25-5.7 mm and in hydrogen, in the pressure range 3 x 10^-9-1.5 x 10^-2 Torr, over the gap length range 0.33-2.6 mm. It has been found that the breakdown voltage, the electric field enhancement factor, and the prebreakdown current are independent of the electrode-glass-insulator distance in the range 1-12.65 mm for a fixed gap length and a fixed radius of curvature of the electrodes. On the other hand, increasing the gap length causes an increase in the electrode radius of curvature, an increase in the electric field enhancement factor at the cathode, and finally a decrease in the breakdown voltage. The addition of hydrogen causes an increase in both the prebreakdown current and the field enhancement factor, at a fixed gap distance. 67 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Electrode Geometry; Ultrahigh Vacuum

Secondary Keywords: Stainless Steel Electrodes

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3706
(SWITCHES, CLOSING; SWITCHES, OPENING; BREAKDOWN STUDIES)

(Gas Gaps, Materials; Gas Gaps, Materials; Electrodes)

ELECTRODE PHENOMENA IN A HIGH CURRENT, DC-NANOSECOND SPARK

H. Fischer and C.C. Gallagher
AFCRL, Bedford, MA 01730
Applied Optics, Vol. 6, No. 12 p. 2116 (12/1967).

Directed filars from the anode of a 0.85 mm gap in 1 atm of air appear to be a type of plasma wave emitted appearing after current cutoff. The kink collapse using the initial electrode processes. The development of the spark channel and the related afterglow are also discussed. 11 Refs.

Primary Keywords: Electrode Erosion; Metal Vapor Jets; Optical Phenomena; Twenty Nanosecond Duration

COPYRIGHT: 1967 OPTICAL SOCIETY OF AMERICA

3707
(SWITCHES, CLOSING; SWITCHES, CLOSING)

(Vacuum Gaps, Electrical; Vacuum Gaps, Materials)

FIRING CHARACTERISTICS OF A TRIGGERED VACUUM GAP EMPLOYING DIELECTRIC COATED WITH A SEMICONDUCTING LAYER

G.R. Govinda Raju, R. Hackem and F.A. Benson
University of Sheffield, Sheffield, UK

Journal of Applied Physics, Vol. 46, No. 3 pp 1101-1105 (05/1976).

Some electrical properties of a triggered vacuum gap incorporating five different dielectric materials coated with a semiconducting layer to produce a low surface resistance are studied. The dielectric materials used are high-alumina ceramic, steatite ceramic, cerium titanate, silicon carbide, and boron nitride. It has been found that the probability of firing and the time delay to firing generally decreases with an increase of both the trigger energy and the trigger voltage until saturation is reached. The minimum trigger voltage for successful firing is about 300 V for all substrates except for barium titanate which is higher at 700 V. The higher trigger voltage in the case of barium titanate is attributed to the difficulty of coating this material evenly with the particular semiconducting layer used of colloidal solution of aquadag carbon. A new method is described to rejuvenate a TVG which ceased to operate by applying a keep-alive direct current superimposed on the trigger pulse voltage. A mechanism responsible for this phenomena is also discussed. 10 Refs.

Primary Keywords: Triggered Vacuum Gap; Multiple Dielectrics; Semiconductor Coating; Aquadag Copper Electrodes

Secondary Keywords: Reliability

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3708
(PARTICLE BEAMS, ELECTRON)

(Reviews)

HIGH POWER RELATIVISTIC ELECTRON BEAMS IN PLASMA AND IN VACUUM

B.M. Bratman and D.D. Ryutov
Institute of Nuclear Physics, Academy of Sciences of the USSR,

Novosibirsk, USSR

Sandia Report No. SAND-74-6022 (01/1975).

Trans. From: Preprint 179-74 By P. Newman

Availability: SAND-74-6022

NTIS

In this review the authors discuss the possibilities of using high power relativistic electron beams for plasma heating in open systems. We shall consider the following three groups of questions: 1. Beam transport in a vacuum in a strong magnetic field, equilibrium, stability, and critical beam currents in vacuum. 2. Beam transport in plasma, charge and current neutralization of the beam; plasma heating by a reverse current; macroscopic beam instabilities in plasma. 3. Theory of collective beam relaxation in plasma, including damped and nonlinear relaxation modes; the role of plasma instability; macroscopic effects during beam relaxation. The review encompasses publications up to September 1974. 14 Refs.

Primary Keywords: Relativistic Electron Beam; Beam-Plasma Interaction; Vacuum Transport; Critical Beam Current

Secondary Keywords: Instabilities; Relaxation

3709
(INSULATION, MATERIAL)

(Liquid)

INFLUENCE OF SPECIMEN SIZE ON THE DIELECTRIC STRENGTH OF TRANSFORMER OIL

W.R. Bell
University of Newcastle Upon Tyne, Newcastle Upon Tyne, UK
IEEE Transactions on Electrical Insulation, Vol. EI-12 No. 4 pp 281-292 (08/1977).

The results of some specimen size effect experiments on technical grade transformer oil are reported. Four electrode areas (1.77, 8.19, 37.9 and 177 sq cm.) and four gap spacings (0.215, 0.464, 1.0 and 2.15 mm) were investigated using a fast ramp 5 x 1E12 V/cm^sup-1/s^sup-1 and an AC ramp (12 kV/cm^sup-1/sec^sup-1/sec^sup-1). Whilst the results are in general agreement with weak link theories, it is suggested that physical specimen size factors play a significant part. Examples of physical size factors are spark conditioning, electrode profile, and liquid motion. 18 Refs.

Primary Keywords: Dielectric Strength; Transformer Oil; Specimen Size Influence; Uniform Field; Plane Electrodes; Parallel Electrodes; Electrode Effects

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

3710
(SWITCHES, CLOSING; SWITCHES, OPENING)

(Gap, Materials; Gas Gaps, Materials)

INVESTIGATION OF THE EROSION PHENOMENA IN HIGH CURRENT, HIGH PRESSURE GAS DISCHARGES

J.E. Gruber and R. Suess
Inst. für Plasmaphysik, Garching, FRG

IPP Report No. IPP 4/72 (12/1969).

Erosion, resulting from discharges whose total current is between 1 and 10 coulombs, is measured for electrode gaps of 1.5 mm and 13 mm and for pressures from 1 to 5 atm at a gap separation of 1.5 mm. Pressure was found to have no effect on the electrode erosion whereas the gap distance did. Experiments were done for Aluminum, Brass, Stainless Steel, Molybdenum, Tungsten and Tungsten-Copper electrodes. 0 Refs.

Primary Keywords: Electrode Erosion; Parallel Electrodes; Small Charge Conductors; Variable Gap Width; Several Electrode Materials

3721
(BREAKDOWN STUDIES)
(Gas; Optical)

BREAKDOWN OF AIR NEAR TRANSPARENT DIELECTRICS
A.M. Bonch-Bruevich, V.I. Zinchenko and L.N. Kaporskii
Soviet Physics-Techical Physics, Vol. 22, No. 5 pp. 629-631 (06/1976).
Trans. From: Zh. Tekh. Fiz. 47, 1055-1058 (May 1977)

An experimental study is made of the breakdown of air near the surface of a transparent target irradiated by a series of giant pulses. The observed decrease in the breakdown threshold is not due to processes occurring at the focus of the lens focusing the radiation. The breakdown of air is initiated in the immediate vicinity of the dielectric surface and is not affected by the distance from the focus to the surface. The breakdown of air near the surface of a dielectric is not due to evaporation of the dielectric material. It is suggested that the breakdown is initiated by microscopic inhomogeneities which result from the contact of the surface with the surrounding medium. 7 Refs.

Primary Keywords: Air Discharges; Dielectrics; Laser-initiated Breakdown

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3722
(SWITCHES; CLOSING; BREAKDOWN STUDIES)
(Gas Gaps; Self; Gas; Electrical)

COMPUTATION OF IONISATION GROWTH AT HIGH CURRENT DENSITIES
A.J. Davies, C.J. Evans and P.M. Woodson
University College of Swansea, Singleton Park, Swansea, Wales
Proc. IEE, Vol. 122, No. 7 pp 765-768 (12/1974).

The paper gives a numerical method for integrating the differential equations describing the ionization of gases in the discharge gap between electrodes. The method improves upon previous work in that it allows the charge to be traced through the later stages up to currents of 20-100A. The computed data is found to agree closely with previous experimental values of light output and total current. 8 Refs.

Primary Keywords: 1-dimensional Ionization; Plane Electrodes; Parallel Electrodes; Small Gap; Theory; Experiment

COPYRIGHT: 1975 INSTITUTE OF ELECTRICAL ENGINEERS

3723
(SWITCHES; CLOSING)
(Gas Gaps; Electrical)

HIGH POWER SPARK GAP SWITCH DEVELOPMENT

W. Clerk
Maxwell Labs Inc., San Diego, CA 92123
AFAPL Report No. AFAPL-TR-75-41 (05/1975).
Availability: AD-A015 072
NTIS

A pressurized spark gap switch is described which is capable of high repetition rates in the multi-megawatt average power range. This switch used airflow to remove the hot gas generated by the conduction current. A two electrode pair version of this switch has been operated at repetition rates up to 500 pps and simulated average power levels up to 5.6 megawatts in bursts of several seconds with an air flow on the order of 150 CFM per electrode pair. The switch was tested using a simulation technique which duplicates the high power electrical waveforms experienced by the switch but requires less operating power than is transferred to the load under actual operating conditions. Using this testing scheme, a broad base of statistical experimental data was generated on spark gap switch operation at high average power levels. The data from these tests indicates that the switch performance is strongly influenced by the gas flow velocity in the gap region. This velocity is determined by the electrode shape, the gas flow geometry, the gas flow rate, the gas pressure, and the gap length. Other important variables involved were found to be the switch voltage, the electrical charge transferred per shot, the recharging voltage rise time, the pulse repetition frequency, and the pulse period or zero voltage time. 47 Refs.

Primary Keywords: High Power Spark Gap Switches; High Repetition Rate Switches; Switches For High Power Pulse Modulators; Spark Gap Switches

3724
(BREAKDOWN STUDIES)
(Gas; Optical)

MEASUREMENT OF THE WAVELENGTH DEPENDENCE OF THE THRESHOLD OF LASER-INDUCED GAS BREAKDOWN

R.C. Byron and G.J. Part
University of Hull, Hull, UK
J. Phys. D: Appl. Phys., Vol. 12 pp. 401-408 (07/1979).

Experiments are described which study the wavelength scaling of cascade breakdown in a tunable dye laser with a peak output power of 60 MW in a 18 ns pulse. It is used over a wavelength range of 720-840 nm to measure the threshold breakdown intensity in the rare gases helium, argon, and krypton, and in the molecular gases hydrogen and sulphur hexafluoride all at 100 Torr. The data obtained for the rare gases agree well with the cascade breakdown theory while the molecular gases varied greatly from the theory possibly due to the effects of molecular vibrational levels. 12 Refs.

Primary Keywords: Gas Discharges; Laser-induced Breakdown; Wavelength Dependence; Focal-spot Dependencies; Breakdown Threshold

COPYRIGHT: 1979 THE INSTITUTE OF PHYSICS

3725
(PARTICLE BEAMS; ION)
(Generation)

MICROSECOND OPERATION OF A GENERAL PURPOSE FUSED PROTON GUN
S. Humphries and G.H. Kusun
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 35, No. 1 pp 13-16 (07/1979).

A magnetically insulated pulsed proton gun is described that provides an extracted parallel beam of annular cross section for microsecond pulse lengths. In initial tests, time-averaged currents of 5 kA and current densities of 50 A/cm² were achieved with < 200 kV voltage. The behavior of the gun appears to be determined by instabilities of the cathode electron cloud growing over time scales of the order of 0.5 microseconds to give ion current-density enhancements greater than a factor of 50 above the Child-Langmuir limit. 5 Refs.

Primary Keywords: Magnetic Insulation; Annular Cross Section; Microsecond Pulse Length; Cathode Instability

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3726
(BREAKDOWN STUDIES)
(Gas; Opt. cal)

MODELING OF THE BREAKDOWN OF A DENSE MOLECULAR GAS BY LASER RADIATION CLOSE TO A METALLIC SURFACE

V.I. Mezhukin, A.A. Ugov and B.N. Chetverushkin
M.V. Keldysh Institute of Applied Mathematics, Academy of Sciences of the USSR

Soviet Physics Doklady, Vol. 24, No. 6, pp 443-446 (06/1979).

The authors use methods of numerical simulation to investigate the phenomenon of optical breakdown of molecular nitrogen by laser radiation with wavelength 1.06 microns under conditions when the high pressure essentially suppresses the processes of vaporization of the target substance, and when the thermal emission of electrons from the surface of a molybdenum disk exerts a direct effect on the breakdown mechanism, which, as is known, is an avalanche-ionization process in the region of $P > 1$ atm. 5 Refs.

Primary Keywords: Molecular Gas Breakdown; Neodymium Laser; Metallic Surface; Numerical Calculation

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3727
(ENERGY CONVERSION; ELECTRICAL; PULSE GENERATORS)
(Power Supplies; Reviews)

ANALYSIS OF PHASED ARRAY RADAR POWER SUPPLY SYSTEMS OPERATING UNDER VARIABLE PULSE LOADING CONDITIONS

C.J. Eichenauer
General Electric Co, Syracuse, NY 13201
IEEE 1973 Eleventh Modulator Symposium pp. 138-149 (09/1973).

Detailed quantitative analyses of phased array power systems are often required as a result of the radar system's variable pulse template operating conditions. A matrix format, with system capability factors forming columns and system operating modes forming rows, is presented as a useful type of display for the quantitative results of a power supply system analysis. Four alternate forms of system analysis are then examined: use of steady state techniques, use of analog computer techniques, development of special purpose digital computer programs, and use of one of the general purpose user oriented circuit analysis programs. Examples of a power supply system analog computer analysis and a CIRCUS 2 digital analysis are presented. Advantages and disadvantages of each method of analysis are discussed. 0 Refs.

Primary Keywords: Power Supply; Analysis Techniques; Analog Computer; Digital Computer

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3728
(SWITCHES; CLOSING)
(Gas Gaps; Materials)

NONLINEAR SURFACE PHOTOELECTRIC EFFECT IN METALS SUBJECTED TO INTENSE LIGHT

I.I. Kantorovich
V.I. Lenin Belarusian State University, Minsk
Soviet Physics-Techical Physics, Vol. 22, No. 3 pp 397-399 (03/1977).
Trans. From: Zh. Tekh. Fiz. 47, 660-664 (March 1977).

Recently there has been renewed interest in the surface photoelectric effect of metals. When a metal is irradiated by a laser the photoelectric effect is nonlinear. In the present note we derive a general equation for the electron emission current. 5 Refs.

Primary Keywords: Surface Photoelectric Effect; Laser Light; K-photon Secondary Keywords: Fermi Energy

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3729
(INSULATION; MATERIAL; INSULATION; VACUUM; SWITCHES; CLOSING; SWITCHES;
OPENING; REVIEWS AND CONFERENCES)

REVIEWS; Reviews; Reviews; Reviews; Reviews
REVIEW OF DIELECTRICS AND SWITCHING

A. S. Denholm
Energy Sciences Inc., Bedford, MA 01730
AFWL Report No. AFWL-TR-72-88 (02/1973).
Availability: AD-A07739
NTIS

Systems to generate high power levels frequently operate at high voltage, and their design requires special knowledge of dielectric and switching technology. The treatment of these technologies in this report starts with a discussion of electric field analysis then covers insulation and switching in the four dielectric media: namely gas, liquid, solid and vacuum. An extensive search of the literature produced a listing of relevant books, reports and papers and the establishment of a punched card classification and retrieval system especially designed for the subject area. 6 Refs.

Primary Keywords: Electric Field Profile; Dielectric Properties; Breakdown; Tracking; Solid State Switches; Circuit Breakers; Spark Gaps

3730
(BREAKDOWN STUDIES)

GAS; Electrical
AFTERGLOW TAILS AND STABILITY OF HIGH-DENSITY NANOSECOND ARC CHANNELS

H. H. Ho and W. Ruppel
AFCLR, Bedford, MA 01730
Applied Optics, Vol. 3 pp. 769-772 (08/1963).

Experiments are presented which study the afterglow tail of a 10 μm arc channel in air at 760 Torr. The photodetector was protected from saturation by a gated Kerr cell which reduced some intensities by a factor of four. Multishots are used to get integrated arc images with gains up to 500 ns. 3 Refs.

Primary Keywords: Afterglow Tails; Arc Channels; Spectral Intensity; Temporally Resolved

Secondary Keywords: Kerr Cell

COPYRIGHT: 1964 OPTICAL SOCIETY OF AMERICA

3731
(BREAKDOWN STUDIES)
(Gas, Electrical)

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF PULSED DISCHARGES IN GASES

V. Yu. Baranov, V. V. Petrushovich, Yu. B. Smekhovskii, A. M. Starostin
and A. P. Strelkov

Soviet J. Quantum Electronics, Vol. 9, No. 12 pp. 1509-1515 (12/1979).

Transl. from Kvantovaya Elektron., (Moscow), No. 2552-2561 (December 1979).

A numerical investigation was made of the properties of pulsed self-sustained discharges in gases, and of the ways in which their development was affected by nonmonotonic dependences on the electron drift velocity on the ratio of the field to the density and on other parameters. The procedure used made it possible to perform calculations for discharges having large discharge gaps and, at the same time, to study the detailed distributions of the electric field and of the ion and electron densities in the discharge gap. The calculations were in good agreement with the results of an experimental investigation of a large-volume nonself-sustained discharge. 34 Refs.

Primary Keywords: Pulsed Discharges; Theoretical Investigation; Experimental Investigation; Self-sustained; Nonself-sustained

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

3732
(PARTICLE BEAMS, ELECTRON)
(Generation)

TRANSFORMER-TYPE HIGH-CURRENT ACCELERATOR

Ye. A. Abramyan and V. A. Gaponov

Institute of Nuclear Physics, Academy of Sciences of the USSR,

Novosibirsk, USSR

USSR Academy of Sciences Monograph (03/1970)

Transl. from Monograph Sistemochnyi Uzkorilelnye Osnowa Transform

Availability: JPRS 50119

NTIS

This article contains a description of the operating principle of a direct-action accelerator designed to accelerate electrons to an energy of 1.5 megaelectron volts with an average beam power of tens of kilowatts and an efficiency of about 90 percent. The accelerator is a transformer with a core made up of insulated sections with a built-in accelerating tube operating on a 50 hertz network in a compressed gas environment. Constant electron energy is insured by voltage stabilization in the tube by means of current regulation. The pulse length of the electron current is regulated from zero to five microseconds, and the current rate to 10 milliamperes per second. The mean current can reach 1/6 of the maximum current in the pulse. Magnetic lenses are installed in the tube to bring an electron current up to 100 milliamps through the accelerating tube in a beam with a diameter of several millimeters. Heavy metal shields near the tube axis protect the gas gaps and other electrically stressed sections of the accelerator from radiation. There is a structural description of a device in which an electron beam is obtained with an energy of 1.5 megaelectron volts and an average power of 25 kilowatts. 6 Refs.

Primary Keywords: Transformers, Accelerating Tube, Electron Beam; Hot-Cathode Diode

3733
(PARTICLE BEAMS, ELECTRON)

(Target Interactions)

TWO DIMENSIONAL FLUID SIMULATION OF RELATIVISTIC ELECTRON BEAM-HIGH Z TARGET INTERACTIONS

D. G. Columbant and D. Mosher

Naval Research Lab., Washington, DC 20375

NPL Memorandum Report No. 3496 (05/1977).

Availability: AD-A049090

NTIS

A two-dimensional r-z fluid code has been developed to study the interaction between a relativistic electron beam and an anode plasma. A self-consistent treatment of the electromagnetic fields has been included. Radial pinching of the beam is observed when its self-field resistively diffuses into the plasma. 8 Refs.

Primary Keywords: Relativistic E-beam; Two-dimensional Fluid

Simulation; Diode Flow; Pinch Formation

3734
(SWITCHES, CLOSING)

(Explosive Fuses)

WHYRAC, A NEW MODULAR ONE-DIMENSIONAL EXPLODING WIRE CODE

D. G. Columbant (1), M. Lampe (1) and H. W. Bloomberg (2)

(1) Naval Research Lab., Washington, DC 20375

(2) Science Applications, McLean, VA 22209

NRL Memorandum Report No. 3726 (02/1978).

Availability: AD-A153584

NTIS

A new one-dimensional code, WHYRAC, intended to provide a comprehensive treatment of exploding wires and wire arrays, is described. The circuit equations treat the wire plasma in an exact way, rather than using a lumped circuit model. Great care has been taken in the Eulerian MHD treatment of plasma motion, resulting in an unusual combination of rapid running capability to handle density ranges spanning at least four orders of magnitude, and very accurate energy conservation in the overall circuit. The code is written in a modular and flexible way, to permit continual upgrading, and extension to different elements of the atomic physics and radiation transport packages. At present, a fairly simple, rapid-running model is used to provide transport of each time step. A much more extensive, state-of-the-art, atomic radiation code is used to generate output radiation spectra. It is also possible to benchmark the energy transport package. In recent years, special attention to the treatment of numerical diffusion has been given. 1. Refs.

Primary Keywords: Z-pinch; Wire Pinched Plasma; Numerical MHD

3735
(BREAKDOWN STUDIES)

(Gas, Electrical)

SIMULATION OF THE GROWTH OF AXIALLY SYMMETRIC DISCHARGES BETWEEN PLANE PARALLEL ELECTRODES

A. J. Davies, C. J. Evans and P. M. Woodson

University College of Cardiff, Singleton Park, Swansea, Wales

Computer Physics Communications, Vol. 14 pp. 287-297 (12/1977).

A program is presented that uses a two-dimensional numerical method to simulate the complete breakdown of an axially symmetric discharge in the presence of primary ionization, reionization of ions after attachment, detachment, and secondary ionization from the cathode due to the incidence of photons and positive ions. All are taken into account. A test run for a discharge in air is outlined. 4 Refs.

Primary Keywords: Discharges; Numerical Calculations; Plane Electrodes; Ionization; Ionization; Axially Symmetric

COPYRIGHT: 1977 NORTH-HOLLAND PUBLISHING COMPANY

3736
(PULSE GENERATORS)

(Pulse Forming Lines)

H. Fischer NANOSECOND PULSES OF VERY LOW IMPEDANCE

AFCRL Bedford, MA 01730

AFCRL Report No. AFCL-65-219 (04/1965).

Availability: AD-A14900

NTIS

Nanosecond pulses exceeding 2000 A are obtained by discharging a plate capacitor transmission line of very low impedance through an air gap. High repetition rates exceeding 20 kHz are possible, also triggered single shots with a time jitter of less than a nanosecond. A compact model of the pulser for operating a laser diode is described. Lower pulses covering a wide current range conveniently are produced by the same geometry, using a mercury wetted contact switch. 7 Refs.

Primary Keywords: Transmission Line Pulser; Repetited; Low Jitter

3737
(SWITCHES, CLOSING)

(Miscellaneous)

APPLICATION OF THE RSR SWITCH

R. A. Hill and R. A. Smith

Westinghouse Electric Corp., Baltimore, MD 21203

IEEE 1975 Eleventh Modulator Symposium pp. 95-106 (09/1975).
The Reverse Switching Rectifier, a four terminal solid-state switch, has been successfully applied in several pulse modulator designs. The modulators have demonstrated high reliability and have achieved a substantial reduction in size and weight compared to conventional designs. Thorough testing has been performed including extensive operation under load fault conditions. The RSR modulator day-on techniques are now being applied in a number of new programs. 5 Refs.

Primary Keywords: Reverse Switching Rectifier; Switch; Solid State

COPYRIGHT: 1975 IEEE. REPRINTED WITH PERMISSION

3738
(PULSE GENERATORS)

(Hard-tube)

A CONSTANT CURRENT HARD TUBE MODULATOR

R. Alsmeyer

Raytheon Co., Wayland, MA 01778

IEEE 1975 Eleventh Modulator Symposium pp. 75-78 (09/1975).
Modern air defense radars require reliable stable high-power transmitters. This paper describes the modulator for the final amplifier stage for such a transmitter. It is completely solid-state except for the high-power switch tube and the rub器 spark gap. The modulator drives a crossed field amplifier tube. 2 Refs.

Primary Keywords: Constant Current; Solid State; Crossed-field

COPYRIGHT: 1975 IEEE. REPRINTED WITH PERMISSION

3739
(SWITCHES, CLOSING)

(Miscellaneous)

A HIGH SOLID STATE SWITCH FOR POWER PULSE MODULATOR APPLICATIONS, THE REVERSE SWITCHING RECTIFIER

J. B. Brewster and P. F. Pittman

Westinghouse Electric Corp., Pittsburgh PA

IEEE 1975 Eleventh Modulator Symposium pp. 6-9 (09/1975).
The Reverse Switching Rectifier is a new solid-state switching device with performance optimized for short, high rate of rise pulse current switching. It is a two terminal device which switches from blocking to conduction upon application of a fast rising pulse of voltage. Devices with peak pulse current ratings of 1200 A and diode ratings of 2000 A/microseconds are available with blocking voltage ratings of 1000 V at 125 °C. A typical value of turn off time is 50 microseconds at 25 °C. Many practical pulse modulator circuits have been built using series and parallel combinations of RSR's to demonstrate the use of this device in power pulse modulator service. 4 Refs.

Primary Keywords: Reverse Switching Rectifier; First Turn-on Device; High-Voltage

COPYRIGHT: 1975 IEEE. REPRINTED WITH PERMISSION

3740
(POWER CONDITIONING)

(Pulse Forming Networks)

A POST CHARGE REGULATOR

K. H. Smalley

Pavillion Co., Wayland, MA 01778

IEEE 1975 Eleventh Modulator Symposium pp. 1R4-1R8 (09/1975).
This paper describes a novel regulator for a line type modulator to reduce pulse-to-pulse load voltage ripple due to variations in DC charging voltage. Control of the DC voltage is accomplished by dividing the conventional RIN into two series connected networks, and dissipating the excess charge on one of the networks. In many cases, the active element can be a simple capacitor. Regulation is accomplished by use of a closely coupled oscillator which senses the intermediate voltage of the series connection of RIN and controls a solid-state dissipative element to reduce the total voltage to the desired value. The dissipating element need only have a voltage rating somewhat greater than the peak-to-peak ripple variation on charge voltage existing without the regulator. The regulator in all solid-state and circuitry is all ground based. There is no necessity for a fault current diverter across the dissipative element, as a short to ground at any point in the circuit will not damage the regulator. In applications involving staggered repetition rates, linear reduction of pulse-to-pulse resonant charge voltage can be obtained through regulators that maintain the DC HVDC voltage constant. 6 Refs.

Primary Keywords: Regulator; Pulse-to-pulse Voltage Ripple; Dielectric Absorption

COPYRIGHT: 1975 IEEE. REPRINTED WITH PERMISSION

3741
(SWITCHES; CLOSING; SWITCHES; OPENING)
(EBS; EBS)

CHARACTERISTICS AND CAPABILITIES OF THE MODULAR EBS
R.T. Knight and D.J. Bates
Watkins-Johnson Co., Palo Alto, CA

IEEE 1973 Eleventh Modulator Symposium pp. 17-22 (09/1973).

EBS devices have been designed, tested and are now available for use in a wide range of power modulation applications. Current multiplication due to electron beam illumination of a semiconductor diode results in rise times and delay times of a few nanoseconds, on-off ratios of 1E5 or more and the ability to provide multiple or coded output pulses. EBS devices have been tested which can provide up to 400 V output pulses with less than a 3 ns rise time and an EBS device designed for high current operation has been used to produce pulses of 250 A with a 1 ns rise time. EBS devices available at the present time can be used as CRT modulators, for the modulation of injection lasers and as TWT grid modulators. 9 Refs.

Primary Keywords: EBS Devices; WJ-3650 Device; Current Amplification; Low Voltage

Secondary Keywords: CRT Modulator; TWT Grid Modulator

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3742
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

CHARGING AND STABILIZING SYSTEM FOR A PULSED CROSSED-FIELD AMPLIFIER

USING AN SCR-SWITCHED ULTRASONIC INVERTER

T.P. Crowfoot (1) and G.W. Whalley (2)

(1) Admiralty Surface Weapons Establishment, Portsmouth, Hampshire, UK
(2) GEC Marconi Research Labs, Essex, UK

IEEE 1973 Eleventh Modulator Symposium pp. 176-183 (09/1973).

The system described is used to provide a very stable 10 kV d.c. power supply for an RF switched CFA. The stability is provided by a novel quantum stabilisation method using a controllable high frequency inverter to charge an EHT reservoir capacitor to an accurately determined level. The use of a high inverter frequency greatly reduces the bulk of the power supply by eliminating all mains frequency transformers and filters. Similar techniques have also been successfully used for high stability pulse forming network charging systems. 3 Refs.

Primary Keywords: Ultrasonic Inverter; Very High Stability; Crossed-field Amplifier; Thyristor

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3743
(PULSE GENERATORS)
(Hard-tube)

DESIGN AND PERFORMANCE OF THE LAMPF 1-1/4 MW KLYSTRON MODULATOR

P.J. Tallerico, R.L. Cady and J.D. Doss

Los Alamos National Labs, Los Alamos, NM 87545

IEEE 1973 Eleventh Modulator Symposium pp. 56-60 (09/1973).

A design for a very reliable single-triode modulator for a 1-1/4 MW modulating-anode klystron is presented. The operating voltage is 86 kV and the variable pulse length ranges from 200 microseconds to 1.2 ms. The basic modulator circuit, which uses a modified diode bias circuit, and several of the individual components are described in detail. Over 160,000 high-voltage hours have been accumulated on these modulators. The principal failure mechanism is grid emission from the triode. The failures can be anticipated and repaired during a normal maintenance period. The triode is then reprocessed and reused. Tube life data and a summary of the failure modes are presented. 8 Refs.

Primary Keywords: LAMPF Modulator; High Power; Zener Diode Bias Circuit; Failure Mechanisms; Life Test

Secondary Keywords: Klystron Modulator

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3744
(POWER CONDITIONING)
(Pulse Forming Networks)

DESIGN CHARTS FOR DROOP-COMPENSATION NETWORKS

T.A. Weil

Raytheon Co., Wayland, MA 01778

IEEE 1973 Eleventh Modulator Symposium pp. 155-161 (09/1973).

The principles of pulse droop compensation with passive RLC networks are well known, but the practical application of these principles has been hindered by the complexity of analyzing over the simplest cases quantitatively. This paper presents the results of a computer analysis of droop-compensation methods. The tradeoffs are described, and the results are presented in charts that show directly the loss in efficiency versus the amount of droop before and after compensation. The charts also provide the data necessary to determine the component values to provide the selected droop-compensation performance. 1 Refs.

Primary Keywords: Droop-compensation Network; Analysis; Design Considerations

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3745
(SWITCHES; OPENING)
(Fuses)

EVALUATION OF HVDC FUSES AS TWT PROTECTIVE DEVICES

J.V. Stover

Hughes Aircraft Co., Fullerton, CA

IEEE 1973 Eleventh Modulator Symposium pp. 191-193 (09/1973).

This paper concerns itself with the evaluation of series-parallel assemblies of Bendix 5 kV, 1A rms fuses to obtain 50 kV, 4A rms operation; the evaluation of Bendix 10 kV, 4A rms fuses; and the evaluation of Hughes 50 kV, 4A rms experimental fuses. The purpose of this evaluation was to determine the adequacy of the protection provided to a high power, grid biased modulated travelling wave tube in an unattended, multiple transmitter system such a system may have several TWTs operating from a single power supply, and it features highly undesirable short duration crowbar. The entire supply should only one tube. Development, Analysis, Evaluation

Secondary Keywords: Travelling Wave Tube

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3746
(SWITCHES; CLOSING)
(Gases; Optical)

EVALUATION OF STATE-OF-THE-ART HYDROGEN THRATRONS AT EXTENDED RATINGS

B.R. Gray

RADC, Griffiss AFB, NY 13440

IEEE 1973 Eleventh Modulator Symposium pp. 227-231 (09/1973).

Paper describes the background behind a comprehensive test on a group of selected off-the-shelf thyratrons. Specific objectives of the test were (1) determine the maximum operating anode voltage as a function of average current; (2) determine the maximum average current as a function of anode voltage; (3) determine short time on stability and (4) determine the above parameters when the tube is operating in a vibration test stand. While the data is in the form of a preliminary report certain trends are evident. These are (1) the peak voltage which can be achieved is considerably above the rated value if average current is kept lower than rated value. (2) at rated voltage the average current is equal to or close to the rated value. and (3) average current can be raised above the rated value if anode voltage is lowered. 1 Refs.

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3747
(SWITCHES; CLOSING)
(Gases; Optical)

A CO/SUB 2/-LASER-TRIGGERED SPARK GAP

A.V. Nurmiukko

University of California, Berkeley CA

IEEE Journal of Quantum Electronics, Vol. QE-7, No. 9, pp 470-471 (09/1971).

A coaxial spark gap triggered by a high-pressure CO₂ laser has been constructed. High-voltage pulses with subnanosecond rise time and very low jitter have been obtained. The observed low laser energy threshold required to initiate switching suggests an application of the spark gap in controlling and manipulating higher intensity infrared radiation by electrooptic shutters. 3 Refs.

Primary Keywords: CO₂ Laser; Coaxial Spark Gap; Tungsten Electrode; Nitrogen Gas; High Pressure; Low Jitter; Subnanosecond Rise Time

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

3748
(PULSE GENERATORS)
(Systems)

HIGH POWER SOLID STATE MODULATOR FOR COHERENT AGILE MICROWAVE AMPLIFIER

G. Scharf

Selvina SPA, Rome, Italy

IEEE 1973 Eleventh Modulator Symposium pp. 84-88 (09/1973).

The present paper describes a high power broadband microwave amplifier realized for a pulse compression, M.I.T. or frequency agile radar system. After a short description of the amplifier global network, the most important solutions are pointed out, i.e. H.V. microsecond protections, grid modulator circuit, H.V.-ground level interface, amplifier processor. The overall performances obtained are also given. 10 Refs.

Primary Keywords: Solid State Switches; Crowbar; Protection Circuit

Secondary Keywords: TWT Modulator

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3749
(SWITCHES; OPENING)
(Fuses)

HIGH VOLTAGE FUSES FOR PHASED ARRAY RADAR TRANSMITTERS

S. Schneider, A. Buffa and J. Carter

ECOM, Fort Monmouth, NJ 07703

IEEE 1973 Eleventh Modulator Symposium pp. 189-196 (09/1973).

In large phased array radar systems utilizing microwave amplifier arrays connected to a common power supply, it is necessary to provide isolation between a faulted amplifier and the other amplifiers in the array. A series interrupter in the form of a high voltage fuse has been evaluated for this application. The high voltage fuse is attractive due to its low voltage drop, low cost, size and weight. A 50 kV fuse with a current rating of 4 A RMS and a current interruption time of less than 20 microseconds has been developed. This type of fuse has been found satisfactory for the majority of phased array transmitter applications. 0 Refs.

Primary Keywords: High Voltage Fuse; Series Interrupter; Series

Copyright: 1973 IEEE. REPRINTED WITH PERMISSION

3750
(PULSE GENERATORS)
(Previous)

HIGH VOLTAGE PULSE GENERATORS FOR KICKER MAGNET EXCITATION

DC Frander, D. Grier, K.B. Metzmeier and P. Pearce

CERN, Geneva, Switzerland

IEEE 1973 Eleventh Modulator Symposium pp. 129-137 (09/1973).

The fast ejection facilities at the CERN 28 GeV proton synchrotron are being continually expanded to meet the increasing demand for fast ejected beams. The paper describes three new pulse generator systems for the excitation of the kicker magnets of these facilities. Firstly a pulse generator for the fast ejection from the CPS of any desired number of the twenty circulating proton bunches is treated. This equipment can perform up to six ejections per machine cycle with a minimum rate of 25 milliseconds. Extensive laboratory testing of the principal elements such as the electron gun, pulse forming networks and pulsed resonant power supplies is reported on. 7 Refs.

Primary Keywords: Full Aperture Kicker; Pulse Forming Network;

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3751
(SWITCHES; CLOSING)
(Systems)

IMPROVED MULTIGAP ELECTRONIC CROWBAR

W.W. Schadrack

Raytheon Co., Wayland, MA 01778

IEEE 1973 Eleventh Modulator Symposium pp. 204-206 (09/1973).

The open-air multigap crowbar has the following characteristics: (a) rapid firing after application of the trigger pulse, (b) low voltage drop after firing, (c) low energy triggering capability, (d) large range of operating voltage. Under transient conditions, especially following a load arc, however, there is a danger zone of one or more voltages in which the crowbar will self-fire, thus limiting the trigger voltage so that the crowbar will not trigger until the voltage reaches a simple multiplication to the multigap crowbar. The trigger transient conditions, (1) makes it reliably self-triggering at all voltages above 20 percent of its voltage rating, (2) increase the speed of self-triggering at voltages near the rated voltage, (3) the voltage at which the device can be triggered when the operating voltage is increased to provide self-triggering. 6 Refs.

Primary Keywords: Multigap Crowbar; Open-air Gap; Wide Voltage Range; Shunt Capacitor

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

**3752
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)**

LONG PULSE SWITCH AND POWER AMPLIFIER TUBES FOR PHASED ARRAY RADAR
R.E. Byram and J.T. Merk
RCA Corp., Lancaster, PA 19604

IEEE 1973 Eleventh Modulator Symposium pp. 29-34 (09/1973).

Three new tetrode tubes are now in development in 50 kW, 100 kW, and 200 kW sizes for use as long pulse radar switch tubes, and with 10 kW, 20 kW, and 40 kW levels in long pulse UHF and L-Band rf power amplifiers. All three tubes use newly developed tungsten matrix cathodes and are currently being tested for pulse lengths from 1 to 8 milliseconds and with capability for greater pulse lengths. These new cathodes are specially developed for high current long pulses, arc resistance, and long life. Aspects of the tube design and operation in typical service life tests are discussed. 7 Refs.

Primary Keywords: Tetrode Tube; Long Pulse; Tungsten-Matrix Cathode; Pulsed Emission

Secondary Keywords: Phased Array Radar

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

**3753
(SWITCHES, CLOSING)
(Systems)**

MULTIGAP CROWBAR TRIGGERING STUDY

T.A. Weil
Raytheon Co., Wayland, MA 01778

IEEE 1973 Eleventh Modulator Symposium pp. 207-216 (09/1973).

This paper reports the results of a study on triggering problems in the use of multigap crowbars. The validity of various crowbar test methods was studied, and recommendations will be presented. The study also determined which stray inductances and capacitances in the crowbar and its triggering circuit have a significant effect on triggering performance. Bottom triggering was studied as an alternative triggering method that provides firing under all conduit conditions and requires no HVDC blocking capacitor. A multigap crowbar using the results of this study will be described. The crowbar includes improvements in creepage paths and in the electrode capacitor design. The crowbar is corona-free at 180 kV and is reliably self-firing above 50 kV. 8 Refs.

Primary Keywords: Multigap Crowbar; Triggering Problems; Peaking Gap; Bottom Triggering

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

**3754
(PULSE GENERATORS)
(Line Type)**

PULSE GROUP OPERATION OF HIGH POWER LINE TYPE MODULATORS

R.M. Rowe
Stanford University, Stanford, CA 94305

IEEE 1973 Eleventh Modulator Symposium pp. 162-171 (09/1973).

The development of a high power double pulse line type modulator is described. The design goal output of this modulator was two 185 kilovolt 2.5 microsecond pulses with an interpulse separation of 23 microseconds. In order to produce two closely spaced pulses the network of a SLAC standard 65 megawatt single pulse modulator was split electrically, but not physically. An additional hold off diode, thyatron and end of line clipper were installed thus enabling the two networks to function independently while sharing a common charging inductor and power supply. The interaction problems, i.e., sympathetic firing, etc., encountered and the methods used to solve them are discussed. 0 Refs.

Primary Keywords: Line Type Modulator; Double Pulsed Operation; End-of-line Clipper; Pulse Transformer; Thyatron

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

**3755
(PULSE GENERATORS)
(Hard-tube)**

QUENCH MODULATOR FOR COLD-CATHODE CROSSED-FIELD AMPLIFIER

M.I. Corp., Moorestown, NJ 08057

IEEE 1973 Eleventh Modulator Symposium pp. 153-155 (09/1973).

A hard-tube modulator designed by the Missile and Space Radar Division of RCA has achieved versatile performance through use of a type SFD-257 crossed-field amplifier. This CFA features a cold cathode whose emission is initiated by KF drive and terminated by a hard-tube modulator-driven electron. The performance and design features of the transmitter are described, with emphasis on the specialized pulse shaping and hard-tube modulator required by the quench electrode. 0 Refs.

Primary Keywords: Hard-tube Pulse Generator; Quench Modulator; Crossed-Field Amplifier; Variable Power; Variable Repro Rate

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

**3756
(SWITCHES, CLOSING)
(Systems)**

RAPID RECYCLE CROWBAR CIRCUITS

G.R. Lyuta and T.A. Weil
Raytheon Co., Wayland, MA 01778

IEEE 1973 Eleventh Modulator Symposium pp. 217-226 (09/1973).

Crowbar circuits are used across high voltage energy storage capacitors employed in the output stages of high power radar transmitters. Conventional high voltage power supply and crowbar systems require OFF-ON recycle rates in the order of 10 seconds. Circuits were studied which will allow the radar transmitter to be brought back into operation within a hundred microseconds after a short fault condition. Two basic circuits were tested. In the first kind of circuit, the capacitor bank energy is dissipated, as in conventional crowbar circuits, and the bank is then quickly recharged from another capacitor. In the second kind of circuit, the energy in the capacitor bank is temporarily stored in reversed polarity on the same capacitor, and then returned to normal polarity to restore operation. The tests showed that both kinds of circuits worked, with a preference for the second kind described above. Further work is needed on switching devices for this application, and it remains to be determined how fast voltage may actually be reconnected to an RF tube after an arc without causing it to arc again. 7 Refs.

Primary Keywords: Crowbar Circuit; Rapid Recycle; Triggered Vacuum Gap; Triggered Gas Gap; Short Recovery Time

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3757

(PULSE GENERATORS; SWITCHES, CLOSING)

(Line Type; Thyristors)

SOLID-STATE MODULATOR TECHNIQUES TO PROMOTE FAST PULSE FALL TIMES

V.N. Martin

Raytheon Co., Waltham, MA

IEEE 1973 Eleventh Modulator Symposium pp. 89-94 (09/1973).

This paper describes solid-state tail-biter switching circuitry for grid drive tail-biters in hard-tube modulators and tail-biters employed in high pulse repetition rate line-type modulators used in short range search and mapping radars. Tail-biter circuits are most advantageous in producing fast fall times in the video pulses used to drive high power rf amplifiers. This paper describes the use of SCRs in tail-biter circuits that overcome dv/dt limitations which formerly precluded their use in such applications. Results of laboratory experiments and actual circuit implementation in production systems are described. 5 Refs.

Primary Keywords: Tail-bite Circuit; Thyristors; Transistors; Fast Fall Time

Secondary Keywords: Hardtube Pulser; Line Type Modulator

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3758

(SWITCHES, CLOSING; SWITCHES, OPENING)

(Gas Gaps, Crossed-field; Gas Gaps, Crossed-field)

THE CROSSED FIELD SWITCH TUBE AND ITS APPLICATION TO HIGH POWER MODULATORS

M.A. Lutz

Hughes Research Labs., Malibu, CA 90265

IEEE 1973 Eleventh Modulator Symposium pp. 40-46 (09/1973).

This paper describes the principles and recent development of a crossed field switch tube capable of closing and opening an HVDC circuit. The tube operates as a Penning discharge which can be controlled by an externally applied magnetic field. Several of the physical phenomena associated with this tube are described, including ignition jitter, the glow to arc transition, sputtering, gas clean-up and life. One particular tube has reliably interrupted 2.5 kA against 60 kV with a voltage recovery rate of 15 KV/microsecond. Several applications for this tube are described besides those relating to power utility service. These include component protection, HVDC interruption for current-fed line-type modulators and substitution for hard vacuum tubes for higher power hard tube modulators. 12 Refs.

Primary Keywords: Crossed Field Switch Tube; HVDC Circuit; Penning Discharge; Jitter; Glow-to-Arc Transition; Life Test

Secondary Keywords: Hard tube Modulator

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3759

(SWITCHES, CLOSING)

(Thyatron)

THE DEVELOPMENT OF DEUTERIUM THYRATRONS FOR OPERATION AT HIGH DUTY RATIOS AND HIGH AVERAGE CURRENTS

R.J. Wheldon (1) and M.S. Nicholls (2)

(1) MU Valve Co., London, UK

(2) Royal Radar Establishment, Malvern, Worcestershire, UK

IEEE 1973 Eleventh Modulator Symposium pp. 239-241 (09/1973).

A circuit is described in which thyatrtons have been operated at 50% duty ratio with unusually high average current. Two valve types are described which have been developed to give long lives in this class of service. Good inverse-voltage performance and instant-start capability in full power were also necessary. 4 Refs.

Primary Keywords: Deuterium Thyatrton; High Average Current; High Speed

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3760

THE GENERATION OF HIGH FREQUENCY SINUSIDAL AND PULSE WAVEFORMS USING HYDROGEN THYRATRONS

L.J. Kettle and B.P. Hutton
English Electric Valve Co Ltd, Chelmsford, Essex, UK

IEEE 1973 Eleventh Modulator Symposium pp. 150-152 (09/1973).

The circuit of a high efficiency, high frequency sinewave generator using a hydrogen thyatron switch is described and some of its uses are mentioned. Further, a combination of this circuit with a standard pulse modulator circuit enables a high frequency pulse generator to be built which allows a longer than normal recovery period for the thyatron. 0 Refs.

Primary Keywords: Pulse Generator; Waveform Generator; Hydrogen Thyatron; Long Recovery Period

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3761

(SWITCHES, CLOSING)

(Thyristors)

THYRISTORS FOR PULSE MODULATION AT HIGH PEAK AND AVERAGE POWERS

D.E. Cross (1), M.S. Nicholls (2) and F. Wood (2)

(1) Hirst Research Labs., Hemel Hempstead, UK

(2) Royal Radar Establishment, Malvern, Worcestershire, UK

IEEE 1973 Eleventh Modulator Symposium pp. 12-14 (09/1973).

The design problems of a 1-kW pulse modulator thyristor for 2 kV 1 kA operation at 30 microsecond pulse length are discussed, and experimental devices are described. The performance obtained is compared with that of possible alternative devices, both solid-state and gas discharge. 0 Refs.

Primary Keywords: Thyristor Modulator; Experimental Device; Design Problems; High Current; High Speed

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3762

(PULSE GENERATORS)

(Hard-tube)

TRADEX S-BAND TRANSMITTER MODULATOR

P.N. Saenzano (1), R.C. Cirigliano (1) and F. Wood (2)

(1) RCA Corp., Moorestown, NJ 08057

IEEE 1973 Eleventh Modulator Symposium pp. 61-67 (09/1973).

The TRADEX S-Band transmitter modulator is a direct series-coupled floating-deck modulator employing three L5097 Beam Switch Tubes in a parallel connection as the main switch device. The modulator normally operates at a full peak-power level of 15 megawatts and a duty of 0.03 and delivers a -120 KV, 125-ampere pulse to a VXS8250 klystron load. The modulator can generate a wide range of single-pulse or burst-mode waveforms at various PRFs and allows for continuous changing of waveform during a mission without interruption on duty. The constant current characteristic of the BST provides flat-top pulses, inherent regulation features and fault current limiting 0 Refs.

Primary Keywords: Beam Switch Tube; Parallelized Switch Tubes; Variable Pulse Width

Secondary Keywords: Klystron Modulator

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

3763
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)

TRIGGERED CHARGING TECHNIQUES FOR PULSE GENERATING CIRCUITS

G. J. Scoles
English Electric Valve Co Ltd, Chelmsford, Essex, UK

IEEE 1973 Eleventh Modulator Symposium pp. 172-174 (09/1973).

This paper describes several different circuits which can be used to obtain reliable triggered charging. For hydrogen thyratrons modulators with duty cycles in excess of 0.001 it is usually necessary to delay the recharging of the pulse forming network to allow time for switch tube recovery. 0 Refs.

Primary Keywords: Charging Circuits; Command Charging; High Duty Factor

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

3764
(SWITCHES; CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)

4CW100.000 TETRODE PULSE TESTS AT RADC

P. Bryan and H. Beard

RADC, Griffiss AFB, NY 13460

IEEE 1973 Eleventh Modulator Symposium pp. 35-39 (09/1973).

This investigation showed that this tube can provide very stable pulsed performance at a wide variety of conditions well above its 4 megawatt and 40 KV ratings. In an effort to obtain data beyond the published ratings on Tetrode Switch Tubes, the RADC High Power Laboratory conducted an investigation on three versions of the EIMAC 4CW100.000 Tetrodes. These tubes are manufactured for high power short-wave broadcast service. 0 Refs.

Primary Keywords: 4CW100.000 Tetrode; Rise Time Determination; Voltage Drop; Anode Dissipation; High Voltage; High Power

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

3765
(PULSE GENERATORS)
(hard-tube)

600 KW PEAK HIGH REPETITION RATE HARD TUBE MODULATOR

R.A. Ecken and L. Genovia

Stanford University, Stanford, CA 94305

IEEE 1973 Eleventh Modulator Symposium pp. 47-55 (09/1973).

This paper describes the design, fabrication and test results of a modulator for the 220 KW S-Band klystrons which are part of the proposed beam recirculating system at the Stanford Linear Accelerator Center. 0 Refs.

Primary Keywords: Hard-Tube Pulser; Series Modulator; High Rep-Rate

Secondary Keywords: Klystron Driver

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

3767
(BREAKDOWN STUDIES)
(Gas, Electrical)

EXPERIMENTAL INVESTIGATION OF THE STABILITY CONDITIONS OF A DISCHARGE
IN A GAS STREAM

G. A. Galachyan and S. I. Petrosyan

Institute Of Physics Research, Academy of Sciences of the Armenian SSR,
Ashtarak

Sov. J. Quantum Electron., Vol. 7, No. 5 pp. 649-650 (05/1977).

Trans. From: Kvantovaya Elektron. 6, 1143-1144 (January 1977).
It is shown that the flow of a gas through a discharge region gives rise to fluctuation of the current and the amplitude of these fluctuations depend on the gas pressure and flow rate. The conditions for stability of a discharge in a flowing gas are determined. 2 Refs.

Primary Keywords: Electrical Discharge; Flowing Gas; Discharge

Stability Variation With Pressure

Secondary Keywords: Laser Pumping

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3768
(REVIEWS AND CONFERENCES)
(Reviews)

GENERAL CONSIDERATION OF ENERGY COMPRESSION

O. S. Zucker

Lawrence Livermore Lab, Livermore, CA 94550

LLL Report No. UCRL-80047 (10/1977).

Availability: UCRL-80047

NTIS

This general treatment of energy compression deals with some of the fundamental considerations involved in such a process. The authors discuss: 1) the need for complementary energy modes such as magnetic, electric or kinetic energies along which to transfer the energy from one to another; 2) the difference between longitudinal and transverse compression where the former shortens the pulse length and the latter the pulse width; 3) the adiabatic vs. the resistive compression process and the need for coherence; 4) the maximum efficiency path and optimum number of stages to achieve a given compression; 5) the generalized action equation of compression. A variety of compression circuits will be discussed utilizing some of the above mentioned principles. 0 Refs.

Primary Keywords: Energy Compression; Impedance Conversion; Plasma State

3769
(SWITCHES; CLOSING)
(Miscellaneous)

LIGHT ACTIVATED SEMICONDUCTOR SWITCHES

O. S. Zucker

Lawrence Livermore Lab, Livermore, CA 94550

LLL Report No. UCRL-80046 (10/1977).

Availability: UCRL-80046

NTIS

Semiconductor junctions are capable of switching large power densities. As far back as the early 60's, silicon thyristors conducted 10 kA/sq. cm. in the surge mode. Electric fields approaching 100 kV/cm are quite common. The single obstacle in the utilization of these devices in high power applications is the slow current rise of rise, and high power operation was attained in millisecond type applications only. The slow turn-on is due to the slow diffusion of carriers in the absence of an electric field. In order to use these devices to the microsecond rise time regime, light activation which gives flooding the depletion region with laser light provides for instantaneous conduction. The author will discuss the potentialities--theoretical and practical--for the utilization of these devices in high-power applications. In addition, open circuiting potentialities and some techniques to improve the performance and new materials. 0 Refs.

Primary Keywords: Light Activated Semiconductor Switches; Response

Efficiency

3771
(BREAKDOWN STUDIES)
(Gas, Electrical)

PULSED NANOSECOND ELECTRIC DISCHARGES IN GASES

G. A. Mesyats, Y.I. Bychkov and V.V. Kremnev

Academy of Sciences of the USSR, Tomsk, USSR

Sov. Phys. Usp. Vol. 15, No. 3 pp. 282-297 (12/1972).

Trans. From: Usp. Fiz. Nauk 107, 201-228 (June 1972).
We analyze the physical phenomena occurring during the breakdown of gas gaps within times on the order of several nanoseconds or less. It is noted that the streamer mechanism has low probability if the times of formation of the discharge and the fall-off of the voltage across the gap are commensurate with the emission times of the excited molecules. The development of Townsend discharge is made difficult by the strong influence of the space charge of the avalanche. The discharge mechanisms in single-electron and multi-electron initiation are described and the features of their development are outlined. Oscillographic and electron-optical measurement procedures are described and the main experimental results are reported. Theories explaining the main regularities are presented together with the mechanism for initiation and development of discharge in ultra-strong electric fields. It is noted that x-radiation is produced in the discharge. Results are reported on a discharge at a voltage below the static breakdown value, initiated by fast electrons and by intense ultraviolet radiation. 66 Refs.

Primary Keywords: Nanosecond Breakdown; Single-electron Initiation; Multi-electron Initiation; Townsend Discharge; Very Strong Electric Fields

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3772
(SWITCHES, OPENING)

(Gas Gaps; E-beam)

RAPID CUTOFF OF A HIGH CURRENT IN AN ELECTRON-BEAM-EXCITED DISCHARGE

B. M. Koval'chuk and G. A. Mesyats

Institute of Atmospheric Optics, Academy of Sciences of the USSR,

Moscow, USSR

Soviet Technical Physics Letters, Vol. 2, No. 7, pp. 252-25 (07/1976).

Trans. From: Pis'ma V Zhurnal Tekhnicheskoy Fizike 2, 644-648 (1976).
The problem of cutting off a high current like 1E5-1E6 A in a time interval of the order of 1E-7 sec is a central problem in the development of high-power nanosecond pulse systems with inductive energy storage. Apparently the only known current breaker capable of handling high-power, nanosecond pulses is inductive energy storage systems, a device which exploits the explosion of a large number of microminiature conductors. These breakers are single-shot devices, so that their application is limited. We believe that devices with externally sustained volume gas discharges, controlled by electron beams, are promising for use in high-current current breakers. In such a device, which we call an "Injection thyratron", the current is cut off by terminating the injection of electrons into the gas. 5 Refs.

Primary Keywords: E-beam Controlled Opening Switch; Injection Thyratron; Analysis; Theory

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

3774
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Optical; Lightning)

A PRELIMINARY STUDY OF AEROSOL INITIATED CO/SUB 2/ LASER PRODUCED AIR SPARKS AND THEIR ABILITY TO GUIDE ELECTRICAL DISCHARGES

J.R. Greig, R.E. Peacock, R.F. Fernsler, J.M. Vitkovitsky, A.W. DeSilva and D.L. Kehlman

Naval Research Lab, Washington, DC 20375

NRL Memorandum Report No. 3647 (11/1977).

Availability: AD-A05097

NTIS

The time development of air sparks initiated on aerosols near the focal region (f=3m) of a 1 kJ CO/sub 2/ laser beam has been studied. The spark at each aerosol produced a shock wave that expanded spherically at approximately 2E5 cm/sec during the 1.5 microsecond tail of the laser pulse. In time these spherical waves coalesced forming a turbulent cylindrical column from which a cylindrical blast wave separated. The turbulent cylindrical region was nearly stationary (> 100 microsecond time scale) and was able to conduct electrical streamers at greatly enhanced velocities at times as long as one millisecond after the laser pulse. 19 Refs.

Primary Keywords: High Power; Aerosol; Air Breakdown; Electrical Discharge Guiding

Secondary Keywords: Gas Laser

3775
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Optical; Lightning)

A PRELIMINARY STUDY OF AEROSOL INITIATED CO/SUB 2/ LASER PRODUCED AIR SPARKS AND THEIR ABILITY TO GUIDE ELECTRICAL DISCHARGES

J.R. Greig, R.E. Peacock, R.F. Fernsler, J.M. Vitkovitsky, A.W. DeSilva and D.L. Kehlman

Naval Research Lab, Washington, DC 20375

NRL Memorandum Report No. 3647 (11/1977).

Availability: AD-A05097

NTIS

The time development of air sparks initiated on aerosols near the focal region (f=3m) of a 1 kJ CO/sub 2/ laser beam has been studied. The spark at each aerosol produced a shock wave that expanded spherically at approximately 2E5 cm/sec during the 1.5 microsecond tail of the laser pulse. In time these spherical waves coalesced forming a turbulent cylindrical column from which a cylindrical blast wave separated. The turbulent cylindrical region was nearly stationary (> 100 microsecond time scale) and was able to conduct electrical streamers at greatly enhanced velocities at times as long as one millisecond after the laser pulse. 19 Refs.

Primary Keywords: High Power; Aerosol; Air Breakdown; Electrical Discharge Guiding

Secondary Keywords: Gas Laser

3776
(BREAKDOWN STUDIES)

(Gas, Electrical)

CRITERIA FOR SPARK BREAKDOWN IN SULFUR HEXAFLUORIDE

A. Pedersen

The Technical University, Lyngby, Denmark

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-89, No. 8, pp. 2043-2048 (12/1970).

Possible mechanisms of spark breakdown in SF/sub 6/ and other electronegative gases are discussed, and quantitative criteria are derived for the Townsend type and the streamer type of breakdown in non-uniform fields. The Townsend criterion is of considerable physical interest but difficult to apply to engineering problems, whereas the semi-empirical streamer criterion, which holds for impulse breakdown, can be applied to any gas geometry of known field distribution. 23 Refs.

Primary Keywords: SF/sub 6/; Breakdown Mechanism; Townsend Discharge;

Streamer Mechanism; Field Distribution

COPYRIGHT: 1970 IEEE, REPRINTED WITH PERMISSION

3779
(SWITCHES, CLOSING)

(Solid Dielectric, Electrical)

HIGH-PRECISION FAST-ACTING DISCHARGER WITH A SOLID DIELECTRIC

A.B. Gorshunov, L.V. Dubovik and G.R. Zablotskaya

Scientific-Research Institute Of Electro-Physical Apparatus, Leningrad, USSR

Instruments And Experimental Techniques, No. 2, pp. 446-448 (04/1970).

Trans. From: Priroda i Tekhnika Experimenta 2, 120-122 (March-April 1970).

A discharger with polyethylene insulation for the spark gap is described. The discharger inductance is less than 1 cm, its operating range is 30-50 kV voltage range, and the firing time is about 3E-7 sec. 7 Refs.

Primary Keywords: Solid Dielectric Switch; Polyethylene Dielectric;

10-50 kV Operating Voltage; Low Inductance

COPYRIGHT: 1970 IEEE, REPRINTED WITH PERMISSION

- 3806**
(POWER CONDITIONING; POWER CONDITIONING)
(Peaking Caps; Saturable Reactors)
PEAKING THE TRAILING EDGE OF A HIGH-VOLTAGE NANOSECOND PULSE IN AN UNMATCHED LOAD
O.G. Il'lin and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR,
Khar'kov, USSR
Instruments And Experimental Techniques, No. 2, pp 440-442 (04/1970).
Trans. From: Pribory i Tekhnika Eksperimenta 7, 116-118 (March-April 1970)
 Methods of peaking the trailing edge of high-voltage pulses by means of spark gaps and nonlinear inductances are described. Oscillograms of the pulses are given. From the results obtained it follows, in particular, that the methods suggested can be used to obtain durations of 1 to 2 nsec for both the leading and trailing edges of a pulse in an unmatched load. 5 Refs.
Primary Keywords: Pulse Trailing Edge; Edge Sharpening; Triatron; Spark Gap; Nonlinear Inductance; Unmatched Load
COPYRIGHT: 1970 PLENUM PRESS. REPRINTED WITH PERMISSION
- 3812**
(PULSE GENERATORS)
(Reviews)
BE KIND TO YOUR PULSE GENERATOR
M. Marshall
E-H Research Labs, Oakland, CA 94607
Electronic Design, Vol. 1, pp 34-88 (01/1975).
 Problems frequently encountered by pulse generator users, such as improper termination and missing pulses, are examined as are their solutions. Selecting the right generator for different applications and the trade-offs to watch out for are discussed. 0 Refs.
Primary Keywords: Proper Pulse Generator Application; Reading specifications; Care With Cabling
COPYRIGHT: 1975 HAYDEN PUBLISHING CO.
- 3822**
(DIAGNOSTICS AND INSTRUMENTATION)
(B-fields)
ALTERNATING MAGNETIC-FIELD INDUCTION METER UTILIZING THE HALL EFFECT
I.L. Vinnikov and N.N. Katalinova
Institute Of Electronics, Automation, And Remote Control, Academy of Sciences of the Georgian SSR, Tbilisi, USSR
Instruments And Experimental Techniques, No. 5, pp 1221-1224 (10/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 116-119 (September-October 1969)
 An instrument is described for measuring average values of the alternating component of magnetic field induction in air gaps of 1 mm or more at frequencies from 20 Hz up to 10 kHz, within the range from 0.001 to 1.0 T, with an accuracy better than $\pm 2.5\%$. The response of the induction pickup (an indium arsenide-phosphide Hall generator) is linearized over each measuring range. The variations of the induction curve can be observed on an electronic oscilloscope for which connections are provided. The induction meter has been calibrated with known values of constant magnet-c-field induction. 4 Refs.
Primary Keywords: Hall Effect Sensor; 0.001-1.0 T Field Range; 20 Hz-10 kHz Frequency Range; Error Analysis
COPYRIGHT: 1970 PLENUM PRESS. REPRINTED WITH PERMISSION
- 3838**
(PULSE GENERATORS)
(Trigger)
FOUR-CHANNEL UNIT FOR FIRING SPARK GAPS SYNCHRONOUSLY
V.M. Rybin, V.N. Cherepanov, N.I. Zinchenko and V.A. Stepanov
Sukhumi Physicotechnical Institute, Sukhumi, USSR
Instruments And Experimental Techniques, No. 5, pp 1187-1188 (10/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 86-87 (September-October 1969)
 A simple circuit is described for a four-channel synchronous spark-gap firing unit with an independent power supply based on a pulsed rectifier. The device was tested on a modulator at a working voltage of 50 kV. The dispersion in the firing was no more than 50 nsec. 4 Refs.
Primary Keywords: Trigger Generator; Thyatron; Capacitor Energy Storage; 45 kV Output Voltage; 50 ns Jitter; Pulse Transformer
COPYRIGHT: 1970 PLENUM PRESS. REPRINTED WITH PERMISSION
- 3840**
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH-VOLTAGE GAS-FILLED SPARK GAP
V.H. Ishchenko and V.N. Starinskii
Institute Of Semiconductor Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Instruments And Experimental Techniques, No. 5, pp 1185-1186 (10/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 85-86 (September-October 1969)
 A gas-filled spark gap and the results of its electrical tests are described. The spark gap is designed to switch coaxial cables that are charged up to voltages between 10 and 40 kV. 1 Refs.
Primary Keywords: Spark Gap; Field Distortion Gap; Nitrogen Gap; 40 kV Operating Voltage; Breakdown Voltage Measurement; Switching Line Measurement; Rep-rate; 1 Hz Repetition Rate
COPYRIGHT: 1970 PLENUM PRESS. REPRINTED WITH PERMISSION
- 3843**
(POWER CONDITIONING)
(Pulse Transformers)
INCREASING THE MAXIMUM GRADIENTS IN THE WINDINGS OF THE PULSE TRANSFORMERS OF ACCELERATOR FOPENINJECTORS
A.I. Babulin, G.R. Zabitskaya, I.M. Pol'skii and S.P. Yakovlev
Instruments And Experimental Techniques, No. 4, pp 911-915 (07/1969).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 94-98 (July-August 1969)
 The present article describes the results of an investigation of the maximum electric field gradients in the winding insulation of the pulse transformers used for the high-voltage supply of accelerator tubes in high-power accelerators. An increase in the capacitive load leads to an increase in the maximum gradients. 1 Refs.
Primary Keywords: Pulse Transformer; Voltage Distribution; Low Current; Capacitive Loads; Performance Test
COPYRIGHT: 1969 PLENUM PRESS. REPRINTED WITH PERMISSION
- 3855**
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)
PROPAGATION OF HIGH-VOLTAGE STREAMERS ALONG LASER-INDUCED IONIZATION TRAILS
J.R. Vaill, D.A. Tidman, T.D. Wilkerson and D.W. Koopman
Varian Inc, Alexandria, VA 22314
Applied Physics Letters, Vol. 17, No. 1, pp 20-22 (07/1970).
 The channeling and guidance of an electrical breakdown streamer via a laser-induced ionization trail is discussed, and preliminary experiments demonstrating this phenomenon are reported. 15 Refs.
Primary Keywords: Breakdown Channeling; Laser Channeling; Theory; Geometry Considerations
COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 3861**
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SUBNANOSECOND-JITTER LASER-TRIGGERED SWITCHING AT MODERATE REPETITION RATES
J.R. Bettis and A.H. Guenther
AFWL, Kirtland AFB, NM 87117
IEEE Journal Of Quantum Electronics, Vol. QE-6, No. 8, pp 483-491 (08/1970).
 A 50-kV laser-triggered spark gap operated at repetition rates to 50 pps is described. Jitter of delay time as low as $\pm 0.1\text{ nsec}$ was demonstrated. Dependence of delay and jitter was investigated as a function of gas mixture, pressure, laser power, and electrode material. Subnanosecond jitter was obtained with as little as 0.17 mJ in a 6-ns giant pulse from a Nd³⁺ laser in a YAG laser. The dielectric gases used included a high proportion of Ar mixed with N₂/sub 2/ or SF₆/sub 6/. 16 Refs.
Primary Keywords: Nd-YAG Laser; Argon Gaps; Various Electrode Materials; Subnanosecond Jitter; Rep-rated; Life Test
COPYRIGHT: 1970 IEEE. REPRINTED WITH PERMISSION
- 3888**
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)
(Current; Voltage)
HIGH-IMPULSE CURRENT AND VOLTAGE MEASUREMENT
R.J. Thomas
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Instruments And Measurement, Vol. IM-19, No. 2, pp 102-117 (05/1970).
 This paper is a survey of methods of high-impulse current and voltage measurements. Typically, such measurement techniques must now include capabilities for measuring high-energy impulses having peak powers as high as many megawatts, currents as high as many mega-amperes, or voltages as high as several megavolts, with rise times as short as a fraction of a microsecond (even as short as the subnanosecond range for moderately high-energy impulses). These capabilities have been attained in order to meet the needs of various areas of scientific research employing such high-energy impulses. This represents a significant extension in the state of the art of such measurement techniques beyond their more traditional role in development and testing of high-voltage bulk power system equipment. The three most commonly used methods of high-impulse current measurement are the magnetic probe, current transformer, and 'pure' resistive shunt methods. These methods are treated in considerable detail. High-voltage capacitive dividers, resistive dividers, and reflection-type attenuators are covered as the principal methods of high-impulse voltage measurement, with some added discussion of the means of insulating such devices. 41 Refs.
Primary Keywords: Review; Magnetic Probe; Shunt; Capacitive Divider; Resistive Divider; Reflection-type Attenuator
COPYRIGHT: 1970 IEEE. REPRINTED WITH PERMISSION
- 3907**
(INSULATION, MATERIAL)
(Reviews)
SELECTION OF MATERIALS FOR USE AS ELECTRICAL INSULATION-A PHILOSOPHICAL AND SYSTEMATIC APPROACH
J.R. Perkins
DuPont Co, Wilmington, DE 19888
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 3, pp 106-110 (09/1971).
 The selection of a material for use can be simplified by listing the user-requirements/material-properties systematically so that a workable combination of properties can be found. The requirements are organized under the headings of mechanical, thermal, environmental, electrical, and design factors in a logical, systematic, descending order of importance except where economic factors override. 0 Refs.
Primary Keywords: Insulation; Selection Criteria; Mechanical; Thermal; Environmental; Electrical; Economic
COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION
- 3920**
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
LASER-TRIGGERING OF SPARK GAPS BY LASER-INDUCED ION EMISSION
K. Ushihara and M. Kuniyama
University of Tokyo, Bunkyo-ku, Tokyo, Japan
IEEE Journal Of Quantum Electronics, Vol. QE-6, No. 4, pp 239-241 (04/1970).
 A mechanism of laser triggering of spark gaps in which laser-produced ions play the dominant role is investigated for several electrode materials. Spark channels due mainly to laser-produced electrons and channels due mainly to laser-produced ions are clearly distinguished by high-speed shadowgraph techniques. 12 Refs.
Primary Keywords: Laser-produced Ions; Several Electrode Materials; Long Delay Times; Anode Irradiation; Ruby Laser
COPYRIGHT: 1970 IEEE. REPRINTED WITH PERMISSION
- 3937**
(BREAKDOWN STUDIES)
(Gas, Particle)
STUDY OF THE EFFECT OF DUST PARTICLES ON BREAKDOWN VOLTAGES IN AIR
K.H.H. Martinussen and G.R. Bozzoli
The Transactions Of The South African Institute Of Electrical Engineers, Vol. 55, Part 4, pp 133-141 (04/1964).
 The results of a study of the influence of carbon and silica dust in a sphere-sphere air gap is presented. In this paper, it was found that the dust deposited on the cathode has the same contribution to the reduction of breakdown voltage and that dust concentration in the one CAS negligible effect. The Coulomb-Nordheim equation is used to show that this is true. Indeed, the case from a theoretical approach. 9 Refs.
Primary Keywords: Air Breakdown; Sphere-sphere Gap; Dust Particles; Carbon, Silica, Cathode Effects
COPYRIGHT: 1964-1965 SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS

3954

(POWER CONDITIONING)

(Pulse Transformers)

ENERGY TRANSFER FROM A LOW-VOLTAGE CAPACITOR BANK TO A HIGH INDUCTANCE

WITH THE AID OF AN AIR PULSE TRANSFORMER

E. Bar-Avraham (1) and A. Ginzburg (2)

(1) Soreq Nuclear Research Center, Yavneh, Israel

(2) Hebrew University, Jerusalem, Israel

J. Phys. E, Vol. 11, No. 5, pp 120-122 (06/1978).

A method for transferring energy from a capacitor bank to a high inductance load using an air pulse transformer is described. A transformer with a coupling constant of 97, which allows an energy transfer efficiency of better than 55%, is shown to be simple to construct. 4 Refs.

Primary Keywords: Pulse Transformers; High Energy; Tesla Transformer;

High Efficiency

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS

3982

BREAKDOWN MECHANISM OF LASER-TRIGGERED SPARK GAP IN NONUNIFORM FIELD I.

TRIGGER EFFECT AND TIME-LAG CHARACTERISTICS

3987

(SWITCHES, CLOSING)

(Gas Gaps, Thermal)

THE HOT-WIRE TRIGGERED SPARK GAP AT VERY HIGH VOLTAGES

T.E. Broadbent and A.H.A. Shlachter, Manchester, UK

University of Manchester, Manchester, UK

British Journal of Applied Physics, Vol. 13, pp 596-597 (01/1962). The performance of the hot-wire triggered spark gap at voltages up to 1 MV and gap spacings up to 80 cm is described. It is shown that the effect of the hot wire is to lower the breakdown voltage of the gap by as much as half. Optical phenomena which occur in the gap when positive voltage is applied are discussed. 4 Refs.

Primary Keywords: Spark Gap; Hot-Wire Trigger; 1 MV Operating Voltage; Breakdown Voltage vs Wire Temperature

COPYRIGHT: 1962 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

3997

(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)

(Intrinsic; Pulse Forming Lines)

IN-DEPTH NEUTRON SOURCE (IPNS-I) ACCELERATOR 500 MEV FAST KICKERS

D.E. Suddeth and G.J. Volk

Argonne National Lab., Argonne, IL

IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 3024-3025 (06/1979).

Two ferrite loaded picture frame magnets with a kick of up to 15 mrad each are used to extract 500 MeV protons from the IPNS-I accelerator to the neutron source target at the Argonne National Laboratory. The magnet aperture is 10 cm wide by 5 cm high and the length is 60 cm. The single bunch extraction requires a magnetic field rise time (0 to 100%) of 90 ns and a flattop of 100 ns. The magnets receive the 3600 A maximum current via an array of 50 ohm coaxial cables connected in a shunt arrangement. The two legs of each magnet are energized with separate lines to keep the potential to ground to less than 4 kV. The system is designed to run on 30 pulses per second repetition rate. The complete system of control electronics, power supply, driver, gun, thyratron switch, magnet and resistive load is described along with some of the problems of stray inductances and the techniques used to reduce them. 0 Refs.

Primary Keywords: Picture Frame Magnet; 90 ns Rise Time; 3600 A Current; Thyratron; Pulse Forming Line; Rep-rated

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

4010

(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)

(Vacuum, Electrical; Current)

PREBREAKDOWN CURRENT MEASUREMENTS IN VACUUM GAPS STRESSED BY ALTERNATING VOLTAGES

K.A. Narayananikuty and G.R. Nagabhushana

Indian Institute of Science, Bangalore, India

Proceedings Of The IEE, Vol. 123, No. 5, pp 475 (05/1976).

A method of measuring prebreakdown currents in a vacuum gap is described in this paper. A precision transformer is used to sample input voltage, which can then be used to compensate for displacement current in the gap. Currents as low as 0.1 microampere have been measured. A sample Fowler-Nordheim Plot is included. 2 Refs.

Primary Keywords: Prebreakdown Current; Vacuum Gap; Compensating

Transformer; Fowler-Nordheim Plot

COPYRIGHT: 1976 IEE

4013

(SWITCHES, CLOSING)

(Gas Gaps, Self)

PIPE TIME AND TIME DEPENDENT SPARK-GAP RESISTANCE IN NITROGEN AND HELIUM

T.P. Sorenson and V.M. Ristic

University of Toronto, Toronto, Canada

Journal of Applied Physics, Vol. 48, No. 1, pp 114-117 (01/1977).

The rise-time and time-dependent spark-gap resistance in nitrogen and helium were measured using a novel microwave method. Empirical formulas for spark-gap resistance and rise time are proposed, with a maximum error, as compared to experimental results, of $\pm 8\%$. 9 Refs.

Primary Keywords: Self-break Spark Gap; Resistance Measurement;

Temporal Resolution; Nitrogen Gap; Helium Gap

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4014

(PARTICLE BEAMS, ION)

(Current)

TOWARD THE EFFICIENT GENERATION OF INTENSE PULSED PROTON BEAMS

C. Lai, J.J. Lee and R.N. Sudan

University of Illinois, Urbana, IL

Nucl. Instrum. Methods, Vol. 145, No. 1, pp 187-192 (01/1975).

A pulsed electron beam source or a space-charge-limited reflex vacuum triode was used in a proton accelerator to show a marked improvement in the output current and efficiency of the device. In the current machine, a 100 mA 130 keV proton of 6000 A is produced at a current density of 4 amperes. Energies up to 100 keV have been obtained. The efficiency, defined as proton energy output per unit input, has been raised from 10 to 42% by the use of magnetic fields that prevent anomalous electron loss in the beam at the edges of the electrodes. Time-of-flight measurements were also performed. The beam was measured to have a current spread. The results obtained are compared with those related to the ranges of operation of modern electron accelerators. 8 Refs.

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4033

(BREAKDOWN STUDIES)

(Vacuum, Particle)

EFFECTS OF PARTICLES ON HIGH-VOLTAGE VACUUM BREAKDOWN AND INTERELECTRODE CURRENT

J.J. Maley

RCA Corp., Lancaster, PA 19104

Journal Of Vacuum Science And Technology, Vol. 11, No. 5, pp 892-895

(10/1974).

The effect of both dielectric and conducting microparticles on vacuum tube breakdown voltage are considered. It is found that insulating particles can reduce breakdown voltage by 30% while conducting particles typically reduce the breakdown voltage by 45%. It is also shown that it is fairly simple to condition stainless steel electrodes contaminated by dielectric particles. Conducting particles, on the other hand, cause extensive arcing and are very difficult to remove. 10 Refs.

Primary Keywords: Microparticle; Dielectric; Conducting; Effect On Breakdown; Voltage; Conditioning; Stainless Steel Electrode

COPYRIGHT: 1974 THE AMERICAN VACUUM SOCIETY

4043

(BREAKDOWN STUDIES)

(Solid, Electrical)

INVESTIGATION OF BREAKDOWN AND RESISTIVITY STRIATIONS IN HIGH-VOLTAGE SILICON DIODES

A. Muhlbauer, F. Sedlik and P. Voss

Siemens AG, Munchen, FRG

Journal Of The Electrochemical Society; Solid-state Science And

Technology, Vol. 122, No. 8, pp 1113-1116 (8/1975).

The paper presents experiments in which the relationship between microscopic resistivity variations and the breakdown behavior of high-voltage diodes made from silicon wafers cut parallel to the rod axis is studied. The breakdown pattern was found to be striated. Where the stripes regular fluctuations in the resistivity, breakdown occurred at microscopic resistivity minima. Otherwise the distance between breakdown striations was more than twice the minimum distance between resistivity minima. 4 Refs.

Primary Keywords: Silicon Diode; High-voltage Diode; Breakdown; Absolute Resistivity; Variation In Resistivity

COPYRIGHT: 1975 THE ELECTRO CHEMICAL SOCIETY, INC.

4045

(BREAKDOWN STUDIES)

(Gas, Electrical)

ANALYSIS OF SPARK BREAKDOWN CHARACTERISTICS FOR SPHERE GAPS

A. Pedersen, J. Lebeda and S. Vibholm

The Technical University, Lyngby, Denmark

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-86, No. 8, pp 975-978 (08/1967).

The application of a semi-empirical spark breakdown criterion is illustrated and it is shown that it can give a very detailed analysis of known spark breakdown characteristics for the sphere gap. Measurements are reported on scattering in impulse voltage for a 25-cm sphere gap. The results give new evidence for the existence of the Toeppler discontinuity. 13 Refs.

Primary Keywords: Spark Breakdown; Air Gap; Atmospheric Pressure; Sphere Gap; Toeppler Discontinuity; Breakdown Voltage Scatter

COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION

4049

(BREAKDOWN STUDIES)

(Gas, Electrical)

ASYMPTOTIC PLASMA AND SHEATH REPRESENTATIONS FOR LOW-PRESSURE DISCHARGE

S.A. Self

Stanford University, Stanford, CA 94305

Journal Of Applied Physics, Vol. 36, No. 2, pp 456-459 (02/1965).

The collisionless plasma-sheath equation is discussed in a limit that the ratio of Debye length to discharge dimension is vanishingly small. For the cases of plane, cylindrical, and spherical symmetric discharges, asymptotic representations for the plasma and sheath regions are found and numerical results given for the potential profiles, ion currents, energy distributions, and floating wall potentials for two different assumptions regarding the ion generation function in each case. 10 Refs.

Primary Keywords: Low-pressure Discharge; Collisionless Plasma-sheath Equation; Floating Wall Potential; Ion Generation; Electron Distribution Function

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4051

(PARTICLE BEAMS, ELECTRON)

(Generation)

BEHAVIOR OF LOW-IMPEDANCE RELATIVISTIC ELECTRON DIODES IN CONVERGING MAGNETIC GRADIENTS

D.A. Phelps, J.R. Oldenettel, P. Korn and J. Shannon

Maxwell Labs Inc, San Diego, CA 92123

Applied Physics Letters, Vol. 29, No. 6, pp 335-338 (09/1976).

The behavior of a large-area field emission diode located in a 4:1 converging magnetic gradient is described. Evidence is presented that this technique significantly reduces the early-time L/R decay into the nominal 3/4 ohm space-charge-limited impedance characteristic. The elimination of late-time plasma closure in the diode gap is also demonstrated. Due to these characteristics, a significant reduction in the diode's input impedance and an improvement in the pulsed linear diode's power transfer efficiency has been obtained thereby permitting first observations of efficient matching to a sub-ohm pulsed electron accelerator.

Primary Keywords: E-beam Generation; Field Emission Diode; Magnetic Field; Converging Gradient; Diode Impedance Reduction

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4057

(BREAKDOWN STUDIES)

(Gas; Electrical)

STATIC AND DYNAMIC PROPERTIES OF ARCS NEAR PLANE SURFACES

E.J. Los (1) and DC Jolly (2)

(1) General Electric Co., Pittsfield, MA 01201

(2) Massachusetts Institute of Technology, Cambridge, MA

2. Physik, Vol. 20, pp 3-11 (01/1975).

The static and transient behavior of arcs near plane surfaces are analyzed theoretically, and the models obtained are compared with empirical data. The linearization technique of Maekawa was used to predict the static properties of the arcs and showed fair agreement with test results when the surface was dry, but was off when the surface was wet. Phillips' model was used to analyze the dynamic behavior of the arcs, and as before the dry surface results agreed with theory, but the surface results did not. 22 Refs.

Primary Keywords: Dielectric Surface; Dry Surface; Wet Surface; Experiment; Theory; Maekawa's Method; Phillips' Method.

COPYRIGHT: 1975 SPRINGER-VERLAG

4067

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

A 100 KV, FAST, HIGH ENERGY, NONUNIFORM FIELD DISTORTION SWITCH

R.S. Post and Y.G. Chen

Columbia University, New York, NY 10027

The Review of Scientific Instruments, Vol. 43, No. 4, pp 622-624

(04/1972)

A fast closing, high voltage, high energy, nonuniform field distortion switch has been developed. This switch, filled with free-flowing one atmospheric sulfur hexafluoride gas, operates in the cascade mode, and is able to handle 36 kA at 85 KV. These switches have been tested and put into operation with the Columbia high voltage capacitor bank. The overall lifetime between the six switches used is less than 10 nanoseconds at 85 KV. 4 Refs.

Primary Keywords: Field Distortion Gap; SF₆/sub 6/ Gap; Atmospheric Pressure; Flowing Gas; 85 KV Operating Voltage; 10 ns Jitter

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4068

(ENERGY STORAGE, CAPACITIVE)

(Capacitors)

CERAMIC HIGH-VOLTAGE CAPACITORS K-15U-1, K-15U-2, AND K-15U-3

N.V. Stavitskaya (Ed.) and S.Y. Baban (Ed.)

FSTC Report No. FSTC-HI-23-762-68 (03/1969).

Trans. From: Handbook Published By The Standards Publishing House,

USSR (1967)

Availability: AD 687317

NTIS

This report is a translation of a Soviet standard concerning ceramic capacitor fabrication. The present standard applies to capacitors of fixed capacitance having a ceramic dielectric, designed for operation in direct current circuits with a voltage up to 30 KV, in high frequency alternating current circuits with a voltage up to 25 KV rms and in pulse modes. 0 Refs.

Primary Keywords: Ceramic Capacitor; High Voltage; Standard Of Fabrication; Application Data

4069

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

CROWBARRING TECHNIQUE FOR HIGH-VOLTAGE CAPACITOR BANKS

W.K. Tucker

Sandia Labs, Albuquerque, NM 87115

(04/1971).

Availability: SC-DR-710154

NTIS

For abstract, see NSA 25 17, number 41665.

Primary Keywords: Electric Capacitors

4070

(PULSE GENERATORS)

(Capacitor Banks)

CURRENT SHAPING TECHNIQUES FOR HIGH-VOLTAGE CAPACITOR BANKS

W.K. Tucker

Sandia Labs, Albuquerque, NM 87115

(08/1971).

Availability: SC-DR-710463

NTIS

For abstract, see NSA 25 23, number 57268.

Primary Keywords: Electric Capacitors

4071

(ENERGY STORAGE, CAPACITIVE)

(Capacitor Banks)

DESIGN AND CONSTRUCTION OF FAST HIGH ENERGY, HIGH VOLTAGE CAPACITOR BANKS

W. Hess

Lawrence Livermore Lab, Livermore, CA 94550

(06/1969).

Availability: UCID-16166

NTIS

For abstract, see NSA 27 11, number 26591.

Primary Keywords: Electric Capacitors

Secondary Keywords: AEC

4072

HIGH VOLTAGE DOUBLE PULSE SYSTEM FOR THE STUDY OF THRESHOLD SWITCHING MATERIALS

C.H. Culb

Ames Lab, IA (05/1975).

Availability: IS 3459

NTIS

No abstract available.

Primary Keywords: Semiconductor Switches_Performance Testing; Capacitors; Electric Potential; Electronic Circuits; Mechanics; Pulse Circuits; Pulse Rise Time; Pulses;

Secondary Keywords: IS 3459; NTISERDA

4079
(PULSE GENERATORS; POWER CONDITIONING)
(Line Type, Pulse Forming Networks)
HIGH VOLTAGE NANOSECOND PULSE GENERATORS

C. Zavalek
Cobr Electronics Inc, Stamford, CT 06902
Eradcom Report No. DELET-TR-77-2641-5 (05/1980).
Availability: AD A087291
NTIS

A parallel Blumlein circuit, combined with a spark gap switch, was designed for operation at 24 kV, 5 kA peak. Tests were conducted with a single Blumlein with a 10 ohm load. Because of problems with breakdown in the triggered spark gap, a slightly larger spark gap was substituted. An acceptable pulse was delivered from the pulse forming network after adjustment of the inductive elements in the network. 0 Refs.

Primary Keywords: Pulse Generator; Blumlein; Spark Gap Switch; Avalanche Transistor

4080
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)
HIGH VOLTAGE PULSE CAPACITORS

G.S. Kuchinskii
FTD, Wright-Patterson AFB, OH
No. FTD-MG-23-2678-74, 197p (04/1975).
Availability: AD-A017 190/05T
NTIS

High voltage pulse power capacitors are considered in this book. The characteristics of the basic insulation materials are presented. The physical processes arising in pulse capacitors under various operating conditions are considered. A technique is given for calculating the basic dimensions of capacitors, inductance, energy losses, thermal calculations, and evaluation of service life and reliability. The main contemporary types of domestic and foreign pulse capacitors are described.

Primary Keywords: Capacitors; Pulses; High Voltage; Electrical Insulation; Translations; USSR
Secondary Keywords: NTISDDAFAF

4081
HIGH VOLTAGE PULSE GENERATOR

D.L. Pippen
National Aeronautics and Space Administration, Washington, DC
Patent No. PAT-APPL-845 365, (09/1970).
Availability: PATENT-3 530 336
NTIS

A capacitive discharge circuit is employed to produce a controlled, high voltage, fixed energy spark. A fixed voltage for the parallel discharge is provided by a storage capacitor connected in series with a Zener diode. Discharge of the capacitor through the primary of an output transformer is controlled by a separately powered control circuit which employs a silicon controlled rectifier (SCR) as a switching device. A Zener diode employed in the control circuit is subject to the storage capacitor voltage and when the desired capacitor voltage is reached, is driven into conduction to fire a second SCR in the control circuit which in turn activates a relay to energize a ready lamp indicating that the circuit is prepared to deliver a fixed energy spark. The charge circuit is manually fired by closing a switch or is automatically fired each time the circuit is prepared to deliver the fixed energy spark by linking the switching mechanism to the relay. After each discharge, the first SCR is automatically commutated by the back EMF of the output transformer and the second SCR is commutated by the AC input to the control circuit.

Primary Keywords: Patents; High Voltage; Pulse; Generator

Secondary Keywords: PAT-CL-315-241; NTISGPNASA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND POSSIBLY FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

4082
(SWITCHES, CLOSING)
(Thyristrons)
HIGH VOLTAGE PULSE SUPPLY FOR WIPE SPARK CHAMBER BY MEANS OF THYRATRON
K.S.T. Watanabe
Tokyo University, Tanshi (Japan). Inst. for Nuclear Study
(01/1976).
Availability: INS-TM-104
NTIS

The wire spark chamber is being operated conveniently as one of the important track measuring devices in nuclear nucleus interaction experiments with the 1.3 GeV synchrotron in the Institute for Nuclear Study, the University of Tokyo. In order to get the stable operation of the chamber at high efficiency during the experimental period, the pulse supply employing a thyratron used was produced for the high voltage circuits. The thyratron used was CX-1154 (EE and V Co., Ltd.), a high performance tube of reduced time jitter, prolonged life, small internal impedance and short transition time. The pulse supply was produced by using no modular units, not paying special care to the power supply and its stabilization, but mainly considering long term stability and easy maintenance. This set was divided into a main module, bias supply and a condenser bank. As a result, the total transition time in the high voltage circuitry was 140 ns, while the rise time of output pulses was 60 ns. It has operated stably for over 3 months until 1975. The report during the continuous operation at 140 ns is given. 0 Refs. 0 Citations cited on 08/31/1979).

Primary Keywords: High Voltage; Pulse Supply; Wire Spark Chambers; Current Transformers; Power Supplies; Thyristors
Secondary Keywords: In Japan
Distribution Restriction: U.S. SALES ONLY

4084
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

HIGH-VOLTAGE SUPPLY SYSTEM FOR ELECTROSTATIC DEFLECTOR
V.A. Akkuretov, A.A. Giescov, V.V. Kudryashov, M.M. Semenov and N.G. Nekun
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
(01/1978).
Availability: JINR-R-9-11346
NTIS

To increase the efficiency of output of accelerated particles a system of high-voltage supply to the electrostatic deflector of the U-120 M cyclotron was developed. The peculiarity of the system is a possibility of a deep and smooth (90%) regulation of rectified voltage with its stability being preserved. To power the multiplying column assembled using a single-cycle circuit on the 2 T 106 G small-dimensional rectifying posts and K15-4 condensers, a transistor converter and a step-up transformer of an original design or a disconnected ferrite core are used. To raise the transformation coefficient and to obtain voltage of sinusoidal shape the frequency of the converter has been chosen to be equal to the frequency of the successive resonance of the transformer scattering induction with the input capacity of the column. The stabilization system consisting of two thyristor feedbacks attests that combination of deep smooth regulation of rectified voltage and its stabilization with a high accuracy. (Atom index citation 10:441637)

Primary Keywords: Ion Cyclotrons; Beam Extraction; Capacitors; Efficiency; Electronic Circuits; Electrostatic Seats; Ferrites; Flowsheets; Performance Testing; Power Supplies; Voltage Regulators

Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/430302; NTISINIS; NTISFMUR
Distribution Restriction: U.S. SALES ONLY.

4086
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

IMPROVED SYSTEM FOR THE MEASUREMENT OF HIGH-VOLTAGE PULSES
W.A. Stephenson
Sandia Labs, Albuquerque, NM 87115
(05/1976)

Availability: SAND-75-0470
NTIS

A small 71.8 mm x 127 mm (2.83" x 5") capacitive voltage divider is described that is used for measuring waveforms in the 200 kilovolt range with durations of tens of microseconds. The device, immersed in a dielectric fluid, works over the temperature range -21 to +347 exp (-1.65 x 10⁻⁶ exp 0.13). The divider works onto an electronic impedance matching line driver which has selectable division ratios of 10,000, 20,000, 30,000, and works into a 50-ohm load. Total deviation in division ratio for the system is in the order of +/- 1.5 percent to +/- 1.05 percent. (ERA citation 01:018202)

Primary Keywords: Capacitors; Electric Measuring Instruments; Neutron Sources; Electric Potential; Electronic Circuits; Pulsed Neutron Techniques; Pulses; Wave Forms
Secondary Keywords: ERDA/070200; ERDA/440300; NTISERDA

4088
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems; Systems)
PULSER FOR EMP SIMULATION

W.H. Wright Jr.
ECOM, Fort Monmouth, NJ 07703
ECOM Report No. ECOM-4198 (02/1974).
Availability: ECOM-4198
NTIS

This development project was undertaken to provide a pulser capable of driving a low-impedance array of antennas with a high-peak-power, short risetime pulse to simulate the electrical interference effects of an electromagnetic pulse (EMP). The final pulser produced a 100 kilovolt (kV), 72 kiloamperes (kA) output pulse with a 10 nanosecond (ns) voltage rise time and 42 ns current rise time through a single output switch. Additional experiments showed how multiple output switches could reduce the current rise time to 14 ns with a 9 ns jitter. The output switch was a water- or air-filled spark gap, and operation in both modes is described. The report also includes design information on a simple and reliable 100 kV DC switch, a low-impedance high power dummy load, and voltage and current monitoring devices for viewing fast transients. 0 Refs.
Primary Keywords: Capacitor Discharge; Strip Line Pulser; Spark Gap; Water Switch; Dummy Load

4089
(ELECTRIC SURFACE, CAPACITIVE)

Lumped Line Source
REGULATOR FOR HIGH VOLTAGE CAPACITOR BANK
A.N. Korolev and N.V. Lazarev
Inst. of Atomic Energy Institute, Moscow, USSR
(01/1970).
Avn Intel Rep. IIEF 761
NTIS

For abstract, see NSA 25 12, number 28108.
Primary Keywords: Electron Tubes; Linear Accelerators
Distribution Restriction: U.S. SALES ONLY

4090
(ELECTRICAL STUDIES)

TESTS ON POLYMER CAPACITOR BEHAVIOR UNDER FAST TRANSIENT OVERVOLTAGES
J.A. Clegg and K.D. Castle
Space Environ. Center, Houston, TX 77058
Rep. No. NASA TM X-58152 (12/1974).
Availability: NTIS 140330
NTIS

Polymer capacitors were tested to determine failure time when subjected to short duration, high voltage surges caused by lightning strikes. Lightning is of concern to NASA because of possible damage to aircraft, spacecraft circuits. The test was designed to determine the surviving time for tantalum capacitor failure and the amount of overvoltage amplitude which could survive, without permanent damage, in the measurement. All capacitors tested exhibited good recovery from the overvoltage shot pulses with no failure at any voltage, forward or reverse, in less than 25 microseconds. 0 Refs.
Primary Keywords: Circuit Breakdown; Circuit Protection; High Voltage; Failure Analysis; Lightning; Leakage
Secondary Keywords: Electrostatic Filters

4093
(ENERGY STORAGE; CAPACITIVE; PULSE GENERATORS)
(Marx Generators; Marx)
THE E-FECULE, A COMPACT, HIGH-DENSITY, HIGH-PRECISION MARX GENERATOR
D.M. Strickland and W.L. Heatherly
AFRL, Kirtland AFB, NM 87117
AFWL Report No. AFWL-TR-73-196 (11/1973).
Availability: NTIS

A Marx generator with the highest energy density ever achieved (39 J/pound) is described. The unit, which operates at 2 MV in atmospheric SF₆, is 2 m long, stores 18 kJ, and weighs 460 pounds. The design incorporates several novel features: the stage capacitors are 100-kV plastic-cased units with a density of 100 joules per pound; grading is achieved by split grading rings; and a conductive-plate charger and triggers the resistors. Its compactness, light weight, and atmospheric gas insulation ideally suit this Marx design for a variety of applications such as bounded-wave and radiating EMP simulators, plasma devices, laser systems, and space-charge-beam sources. The modular nature allows the open voltage to be increased or decreased as necessary. The unit has a demonstrated erection jitter of less than 10 nanoseconds over a 7:1 voltage range and consequently can be precisely time-tied to test sequences or to other hardware. 8 Refs.
Primary Keywords: High Energy Density; Very High Voltage; Grading Rings; Modular Design; EMP Simulation

4100
(SWITCHES, OPENING)
(Superconductive)
INVESTIGATIONS ON FAST SWITCHING SUPERCONDUCTIVE/NORMALCONDUCTIVE CURRENT BREAKERS (CRYOTRONS)

M. Pillsticker
Institut für Plasmaphysik, Garching, FRG
Proceedings Of The 6th Symposium On Engineering Problems Of Fusion Research, pp 453-457 (1976).
Operating physical equipments often requires switching equipments for the fast interruption of high currents from the current-breaker-branch of a network into an ohmic or capacitive load branch. Considering circuits with superconductive windings breakers working as cryotrons (SC/NC switching) are researched. Requirements for extremely fast current breaking at a minimum trigger energy are defined. Possible are triggering by current pulse and magnetic field pulse. Advantages and disadvantages of the trigger methods are explained. Concepts of breaker units are presented being very small and suitable for single operation as well as in parallel and/or serial arrangement. Breaker-units are switched carrying currents of nearly 800 A at the superconductive state before triggering. Current commutation times less than 0.5 microseconds were measured. The maximum switching voltage across a breaker must be less than 5 kV. 4 Refs.

Primary Keywords: Cryotron; Superconductive Switch; Magnetic Field Triggering; Current Pulse Triggering; Zero Resistance; Finite Resistance; Resistive Load

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4103
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
NOVEL CAPACITOR-DIVIDER VOLTAGE SENSORS FOR HIGH-VOLTAGE TRANSMISSION SYSTEMS

A. Stalewski (1) and G.C. Weller (2)
(1) CEGB, Burrymead House, Guildford GU2 5BN, UK
(2) GEC Measurement Ltd, Stafford, UK
Proceedings Of The IEE, Vol. 126, No. 11, pp 1186-1195 (11/1979).
A design is presented for a new capacitive divider and amplifier system for the protection of high voltage power lines. The effect of trapped charge (charge trapped in the divider after the breaker opens) is considered and a solution is proposed. Parasitic inductance effects and problems with discharges caused by pollution are discussed. 10 Refs.

Primary Keywords: Capacitive Voltage Divider; Performance Test; AC Voltage; Impulse Voltage; Charge Trapping; DC Offset Secondary Keywords: Power Line Protection

COPYRIGHT: 1979 IEE

4105
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
PRECISION REGULATED, 20 KW, MODULATOR PFN CHARGING SYSTEM

C.A. Corson
Westinghouse Electric Corp., Baltimore, MD 21203
1978 IEEE Thirteenth Modulator Symposium pp 34-37 (06/1978).
This paper describes a new, highly efficient, regulated modulator charging system that accurately charges the pulse forming networks (PFN's) in a 14 megovolt modulator to over 3 kV without the use of a conventional high voltage power supply or dissipative regulator. It also insures no load open and short circuits and regulates PFN voltage precisely. The circuit stores a measured amount of energy in a transverse mode as 1/2 L₁/sup 2/ and then transfers it to a PFN capacitor as 1/2 CV₁/sup 2/. This technique uses considerably less parts than previous methods and therefore produces impressive size, weight and cost reductions as well as design simplification. It also charges and regulates PFN's more efficiently than previous methods because of using less parts in the main power path and now using a dissipative regulator. 3 Refs.

Primary Keywords: High Energy; Precise Energy Stored In Transformer; Design & Optimization; No Dissipative Regulator

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

4111
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)
CONTROLLED AVALANCHE RECTIFIER CHAINS FOR ACCELERATING VOLTAGE SUPPLIES
M.H. Hanna
Egyptian Atomic Energy Establishment, Cairo, Egypt
International Journal Of Electronics, Vol. 34, No. 1, pp 121-126 (11/1971).

Controlled avalanche rectifier chains are proposed as an alternative to conventional silicon rectifier chains since voltage sharing capacitors are not needed. Voltage and current distribution is analyzed as are the rectifier current and power ratings. A design example is given. 4 Refs.

Primary Keywords: Controlled Avalanche Rectifier; Series Connection; Voltage Shoring; No Capacitors

COPYRIGHT: 1973 TAYLOR & FRANCIS LTD

4118
PULSE FORMING NETWORKS FOR FAST PUMPING OF HIGH POWER ELECTRON-BEAM-CONTROLLED CO₂SUB 2/ LASERS

K.B. Riese
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-751102-1, 10p (01/1975).
Availability: LAUR-75-1832 HTS

The transverse electric discharge is a widely used technique for pumping CO₂ sub 2 lasers at high pressures for the generation, simply and efficiently, of very high power laser pulses. The development of the electron-beam-controlled discharge has allowed the application of the transverse discharge to large aperture, very high energy systems. LASL is now in the process of assembly and checkout of a CO₂ sub 2 laser which is designed to generate a one nanosecond pulse containing 10 kilojoules, for use in laser fusion experiments. The front end of this laser consists of a set of preamplifiers and a mode-locked oscillator with electro-optic single pulse switchout. The final amplifier stage consists of four parallel modules, each one consisting of a two-stage electron gun and two 35 x 35 x 200 cm gas pumping regions operating at a pressure of 1800 torr with a 3/ exp 1 / sub 2 G/1 (He/M sub 2 /CO₂ sub 2) laser mix.

Primary Keywords: Carbon Dioxide Lasers; Pumping; Electric Discharges; Electron Beams; Pulse Generators

Secondary Keywords: Optical Pumping; NIFERDA

4119
(PULSE GENERATORS)

(Trigger)
SCR TURN-OFF PROBLEM ELIMINATED IN RAPID-FIRE STROBOSCOPE TRIGGER
D. Zinder
Motorola Semiconductor Products Inc, Phoenix, AZ 85008
Electronic Design, Vol. 22, pp 116 (10/1973).

In the circuit presented a low-voltage rectifier and a high-voltage transistor allow the SCR to turn off when the capacitor charging current is greater than the SCR holding current. Pulse rates of greater than 1 kHz can be achieved. 0 Refs.

Primary Keywords: Trigger Generator; SCR Switches; Rep-rated; Charging Circuit

COPYRIGHT: 1973 HAYDEN PUBLISHING CO

4123
(PARTICLE BEAMS, ELECTRON)
(Generation)

EXPERIMENTAL INVESTIGATION OF HIGH-CURRENT RELATIVISTIC ELECTRON FLOW IN DIODES

M. Di Capua, J. Creedon and R. Huff
Physic International Co, San Leandro, CA 94577
Journal Of Applied Physics, Vol. 47, No. 5, pp 1887-1896 (05/1976).

Various aspects of the magnetically self-pinned electron flow patterns in megampere diodes have been investigated. The onset of pinching has been correlated with a transition from Child-Langmuir to parapotential voltage-current characteristics. The average velocity at which the pinch sweeps towards the axis has been measured and is found to be approximately mm/nsec. The invariance of the current under geometrical scaling is demonstrated, and the connection between this invariance and plasma motion is discussed. Measurements of total diode current are compared with existing theories and agreement is found with the parapotential model. 31 Refs.

Primary Keywords: E-beam Generation; Field Emission Diode; Electron Flow; Magnetic Self Pinching; Parapotential Voltage-current Characteristic

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4129
(INSULATION, MAGNETIC)

() MAGNETIC INSULATION OF HIGH VOLTAGES IN VACUUM: COMPARISON OF EXPERIMENT WITH SIMULATIONS

K.D. Bergeron (1), J.W. Poukey (1), M.S. Di Capua (2) and D.G. Pellinen (2)
(1) Sandia Labs, Albuquerque, NM 87115
(2) Physic International Co, San Leandro, CA 94577
Sandia Report No. SAND-78-1145C (09/1978).
Availability: SAND-78-1145C HTS

Experiments on long magnetically insulated vacuum transmission lines at the 700 kV/cm level have been analyzed by comparing with computer simulations. The particle-in-cell code used is 2-D, time-dependent and, like the experiments, coaxial cylindrical. Comparison could be made with current monitors at three intermediate longitudinal positions at both the outer electrode (for total current) and the inner electrode (for boundary current). The overall agreement was quite good, though the measured boundary current was consistently about 22% lower than the simulation values. In addition, a detailed comparison of the radial variation of several time-averaged quantities from the simulation was made with the predictions of the parapotential theory. It was found that the electric potential was very similar in the two cases, but the charge and current densities were not. 12 Refs.

Primary Keywords: Long Transmission Line; Experiment; Theory; Current Measurement; Particle-in-cell Computer Code; Good Agreement

4136
(PARTICLE BEAMS, ELECTRON)
(Transport)

TRANSPORT OF A RELATIVISTIC ELECTRON BEAM TO A FUSION TARGET
I.I. Rudakov
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR

Soviet Journal Of Plasma Physics, Vol. 4, No. 1, pp 40-43 (01/1978).
Trans. From Fizika Plazmy, Vol. 4, pp 72-77, (Jan-Feb 1978). 9 Refs.

Primary Keywords: Vacuum Line; Magnetic Insulation; 5 Meter Distance; 100kW Watt Beam; Turbulent Heating In High Current Diode

COPYRIGHT: 1978 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4143
(INSULATION, MATERIAL)
(Systems)

A GAS-SUPPLY LINE WHICH PERMITS A HIGH VOLTAGE TO BE MAINTAINED ACROSS ITS ENDS

G.C. King, M. Tronc and R.C. Bradford
University of Manchester, Manchester, UK
Journal of Physics E: Scientific Instruments, Vol. 9, pp 1049-1050 (12/1976).

A simple gas-supply line is described which allows a high voltage to be maintained across its ends at gas pressures in the gas line at which electrical breakdown would normally occur. It consists of a series of small, electrically conducting tubes across which resistors are connected in a similar manner to the dynode resistor chain of a photomultiplier. In the present application a voltage of 2.5 kV is maintained across the ends of the gas line, but this may readily be increased. 1 Refs.

Primary Keywords: Gas-supply Line; Enhanced Insulation Properties; Increased Breakdown Voltage; Grading Resistor

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4147
(BREAKDOWN STUDIES)
(Gas, Electrical)

OPERATION OF SLIDING-SPARK ARRAYS FOR LASER PRE-IONIZATION

B. Morris and A.L.S. Smith
University of St. Andrews, St. Andrews, Fife KY16 9SS, UK
Journal of Physics E: Scientific Instruments, Vol. 10, No. 5, pp 551-554 (05/1977).

The electrical conditions necessary for reliable operation of sliding-spark arrays have been determined. The emission from an array can be considerably enhanced by critically damping the spark discharge circuit. When used to preionize a CO₂/sub 2% laser there must be a delay between the array and main discharge pulses, but this delay may be as small as 100 ns and less than the array discharge pulse width. 10 Refs.

Primary Keywords: Sliding Spark; Series Breakdown; Multiple Gaps; Minimum Charging Voltage

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4149
(REVIEWS AND CONFERENCES)
(Conferences)

IEEE 1973 MODULATOR SYMPOSIUM

(09/1973).

This conference record includes 38 papers relating to the generation of medium to high power pulses with very carefully controlled parameters. Papers on switching, pulse generation, and energy storage are included. Thirty seven papers are referenced separately.

Primary Keywords: Modulators; Hard-tube Pulse Generators; Thyatrons; Thyristors

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

4157
(BREAKDOWN STUDIES)
(Gas, Electrical)

FOUR-METER SPARKS IN AIR

M.A. Uman (1), R.E. Orville (1), A.M. Slaten (1) and E.P. Krider (2)
(1) Westinghouse Research and Development Center, Pittsburgh PA
(2) University of Arizona, Tucson, AZ 85721

Journal of Applied Physics, Vol. 39, No. 11, pp 5162-5168 (10/1968).

Sparks of 4-m length in atmospheric air were studied, using high-speed image-converter photography, current and voltage measurements, absolute measurements of radiated light intensity, and high-speed image-converter spectroscopy. Correlated results of the various measurements are presented. The energy balance of the spark is discussed. 12 Refs.

Primary Keywords: Long Spark; Rod-plane Gap; Both Polarities; Photographic Observation; Voltage Measurement; Current Measurements; Comparison With Lightning

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4186
(INSULATION, MATERIAL)
(Liquid)

THE ASSIGNMENT OF APPROPRIATE DIELECTRIC STRESSES IN LIQUIDS

G.K.H. Simcox

Megapulse, Inc., Bedford, MA

5th International Conference On Conduction And Breakdown In Dielectric Liquids pp. 179-182 (07/1975).

Liquid dielectrics are in common use in the electrical equipment industry and are often used, in perhaps greater variety, for the insulating media of high voltage pulse generators. The requirements for these two areas are distinct and different. For the former, long term reliability and economic upkeep are mandatory and, for the latter, the emphasis is on peak performance at low duty cycle. On the one hand the dielectric is stressed continuously by AC-DC voltages and, on the other, the stresses are pulsed at a rate of repetition or less, with seconds between stress pulses. This alone would indicate the use of different stress levels but, for liquids, there are added complications due to contaminants. These seriously reduce the electrical performance of liquids for prolonged AC-DC stress applications but have little influence upon the short, microsecond, pulse performance. Because of these differing requirements and characteristics there are interesting contrasts of style and content in the publications of research workers in these respective fields. 7 Refs.

Primary Keywords: Liquid Dielectric; Dielectric Stress; AC Fields; DC Fields; Impulse Fields; Streamer Velocity

COPYRIGHT: 1975 DELFT UNIVERSITY PRESS

4187
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Vacuum Gaps, Materials)

EROSION CRATERS AND ARC CATHODE SPOTS IN VACUUM

B. Juttner

German Academy Of Sciences, East Berlin, DDR

Beitr. Plasma Physics, Vol. 19, No. 1 pp. 25-48 (01/1979).

The author describes experiments which examine erosion craters on clean, smooth cathodes. The discharges have durations on the order of nanoseconds with a current ranging from 10 to 200 amps. It is proposed that the craters are the result of discharge pressure on molten metal in a spot, and that the spots move in a random manner one crater radius at a time because of the microniches that are formed at the edge of the crater. The dependence of crater size, erosion rate and velocity of spot displacement on current is also measured. 34 Refs.

Primary Keywords: Erosion Crater; Discharge Pressure; Molten Metal; Spot Movement

COPYRIGHT: 1979 ACADEMIE-VENAS

4188
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Vacuum Gaps, Materials)

EROSION STRUCTURES ON CATHODES ARCED IN VACUUM

J.E. Daalder

Eindhoven University of Technology, Eindhoven, Netherlands

J. Phys. D, Appl. Phys., Vol. 12 pp 1769-1779 (01/1979).

The author presents a discussion of the erosion craters that form on the cathode during a discharge in a vacuum using total currents up to a few hundred amps. The cathode materials studied are cadmium, copper, molybdenum, and tungsten. Cathode spots can move either randomly, or along a path determined by the magnetic field, but the spot movement can also be greatly affected by surface contamination. A three-dimensional analysis of a crater is presented. Crater surface area 14 Refs.

Primary Keywords: Cathode Erosion Structure; Vacuum Arc; Low Current; High Purity Electrode; Cathode Spot Movement

COPYRIGHT: 1979 THE INSTITUTE OF PHYSICS

4191
(SWITCHES, CLOSING)

(Surface Discharge, Electrical)

A TEST OF A VACUUM/DIELECTRIC SURFACE FLASHOVER SWITCH

I.D. Smith

Lawrence Livermore Lab, Livermore, CA 94550

Report No. UCID-18555 (02/1980).

Availability: UCID-18553

NTRS

A vacuum surface flashover switch is being considered for >10 kHz operation in a 250 kV, 10 ohm, 40 ns coaxial waveguide. Various possible switch designs are compared, and two promising ones selected for tests in the switch test facility at LLL. The initial test configurations are described. 0 Refs.

Primary Keywords: Vacuum Surface Flashover Switch; High Rep-rate; Low Jitter

4192
(SWITCHES, CLOSING)
(Gas Gaps, Crossed-field)

CROSSED-FIELD CLOSING SWITCH DEVELOPMENT

R.J. Harvey

Hughes Research Labs, Malibu, CA 90265

ECOM Report No. ECOM-76-1313-F (01/1977).

Availability: AD A035609

NTRS

A triode version of the crossed-field closing switch has been successfully tested at average powers of up to 800 kW for burst durations of 30 sec. Unlike most conventional spark gaps, the arc is initiated from a crossed-field glow discharge and occurs at random locations on a shot-to-shot basis. This uniformly disperses the heat loading and erosion over a relatively large electrode surface area which may then be cooled. 10 Refs.

Primary Keywords: Closing Switch; Arc Discharge; Crossed Field

4196
(INSULATION, VACUUM)

(Reviews)

HIGH VOLTAGE BREAKDOWN STUDY: HANDBOOK OF VACUUM INSULATION

M.J. Mulcahy and P.C. Bolin

Ion Physics Corp, Burlington, MA 01803

ECOM Report No. ECOM-00394-20 (02/1971).

Availability: AD 23107

NTRS

The 'Handbook on Vacuum Insulation' discusses the factors influencing breakdown in high voltage vacuum devices. The data on the factors, interactions and theories on vacuum breakdown are interpreted and presented in a manner so as to be useful in the design of microwave and modulator tubes that must operate at voltages greater than 100 kV. It is produced as part of a 5-year program, which was carried out at Ion Physics Corporation, to investigate, under controlled conditions and using factorial design and analytical techniques, vacuum breakdown up to 300 kV for conditions pertinent to high power vacuum tubes. The handbook is intended both as an introduction to, and realistic appraisal of, the use of vacuum as the insulating medium for high voltage and high power tubes. As such, it contains general discussions and recommendations pertaining to factor level, combinations and interactions of some preparation, conditioning and operating procedures, etc. The handbook first describes briefly the experimental program. This is followed by an introduction to the basic phenomena of vacuum insulation and a short review of the major theories of vacuum breakdown. The factors of practical import which influence insulation of metal electrodes in vacuum are then discussed in some detail. A final section briefly discusses the role of solid dielectrics in vacuum insulation. 8 Ref.

Primary Keywords: Electrical Breakdown; Phenomena In Vacuum; Criteria For Vacuum Breakdown; Optical And X-Radiation; Electric Field Enhancement And Etching; Conditioning Procedures; Electrode Materials And Surface Properties

Secondary Keywords: Factors Influencing Vacuum Breakdown; Partial Pressure And Gap Current; Breakdown Voltage And Voltage Collapse

4200
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

HIGH POWER SWITCH DEVELOPMENT

E. Kunhardt and M. Kristiansen

Texas Tech University, Lubbock, TX 79409

AFSOR Report No. AFOSR-TR-80-0171 (11/1978).

Availability: AD A081870

NTRS

Studies on the triggering of a high-voltage, gas-insulated spark gap by an electron beam have been conducted. Measurements of the gap voltage, current, and jitter have been made for a wide range of gap conditions and electron-beam cross-sectional areas. The character of the breakdown, for each condition, has been inferred using photographic techniques. Current rise times of approximately 2 ns with subnanosecond jitter have been obtained for 3 cm gaps with gap voltages as low as 50% of the self-breakdown voltage. The observational time lag, i.e. the interval of time between the application of a voltage pulse to the electron gun and the beginning of the current rise in the gap circuit, was 50 ns. The gases used in this series of experiments were: N₂sub 2/ and Ar, and mixture of N₂sub 2/ and SF₆ at pressures of 1-3 atm. Open shutter photographs show that the discharge is broad in crosssection. A number of papers reporting the results obtained in this program have been given at international conferences and two master thesis were completed. 5 Refs.

Primary Keywords: Electron Beam Triggered Switch; Electron Gun; Spark Gap Switch Model

4201
(SWITCHES; CLOSING; SWITCHES; OPENING)
(Gas Gaps; E-beam; Gas Gaps; E-beam)

HIGH VOLTAGE SWITCH USING EXTERNALLY IONIZED PLASMAS
J.W. Dzimianski and L.E. Kline
Westinghouse Electric Corp., Baltimore, MD 21203
AFMAL Report No. AFMAL-TR-80-2041 (04/1980).
Availability: AD A086761
NTIS

A physical model was developed and the performance parameters were studied for high-voltage high-current on/off switches which use the low energy secondary electrons in an electron beam sustained discharges as the conducting medium. The model equations are presented and described along with the underlying physical assumptions. Electron transport rates and static breakdown voltages were calculated for N_{sub} 2/4, Ar₁:9 mixture and CH_{sub} 6/4 by numerically solving the Boltzman equation to find the energy distribution. Study of steady state performance for N_{sub} 2/4, Ar₁:9 and CH_{sub} 6/4 indicated that the N_{sub} 2/4 : Ar₁:9 was both good candidate gases; hence transient switch performance were studied for these two gases. The performance of the e-beam plasma switches were mapped in a regime where the power delivered to the load is much greater than the e-beam power. Study of e-beam sources pointed to the thin-film field emission cathode as offering a means of controlling e-beam plasma switches with very high control power gain. A switch geometry was suggested using such an e-beam source. 52 Refs.

Primary Keywords: E-Beam; Plasma; High Voltage; High Current; Thin-film Field Emission; Electron Transport Data
Secondary Keywords: Switch

4202
(SWITCHES; CLOSING)
(Gas Gaps; Electrical)

INVESTIGATION OF THE RESISTIVE PHASE IN HIGH POWER GAS SWITCHING
R.C. O'Rourke
Science Applications, La Jolla, CA 92037
LLL Report No. UCRL-13776 (01/1977).
Availability: UCRL-13776
NTIS

The authors derive an empirical formula for the time dependent resistance of a gas spark gap using experimental values of the voltage fall time across a gap. A model is chosen and assumptions are made to reduce the problem to a tractable form. The values obtained experimentally for the fall times of the voltage are inserted to give a formula for the time dependent resistance of the gap. The authors then proceed to consider the problems associated with designing a re-entrant system using spark gaps. 12 Refs.

Primary Keywords: Gas Gaps; Resistive Phase; Empirical Formula; Spark Gap Model

4204
(SWITCHES; CLOSING)
(Gas Gaps; Optical)

LASER CONTROL OF SPARK GAPS
E.A. Lemberg
Joint Publications Research Service, Arlington, VA
JPRS Report No. JPRS-59677 (08/1973).
Availability: JPRS-59677
NTIS

The report contains discussions on the use of pulsed ultraviolet waveband gas lasers to switch spark gaps and the time characteristics of spark gaps activated by laser pulse. 4 Refs.

Primary Keywords: Spark Gap Triggering; Nitrogen Laser; Delay Measurement; Jitter Measurement; Synchronization Of Gaps

4205
(PARTICLE BEAMS, ION)
(Generation)

GENERATION OF INTENSE ION BEAMS IN PULSED DIODES

R.N. Sudan and R.V. Lovelace
Cornell University, Ithica, NY 14850
Physical Review Letters, Vol. 31, No. 19, pp 1174-1177 (11/1973).
The generation of high-current (approximately 1E5 A) pulsed ion beams with ion energy in the range 0.5-10 MeV appears to be possible by modifications of present electron-beam technology. 8 Refs.

Primary Keywords: Ion Beam Generation; Ion Emission; Electron Current Suppression; Transverse Magnetic Field

COPYRIGHT: 1973 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

4208
(PARTICLE BEAMS, ELECTRON)
(Generation)

DWL II DIODE STUDY
K. Chidlers and C. Stallings
Physic International Co., San Leandro, CA 94577
DNA Report No. DNA 4432F (12/1977).
Availability: AD A052578
NTIS

An experimental program performed on the DWL II pulsed electron beam accelerator with mean electron energy of 950 keV and electron beam energy of 80 kJ has been accomplished. The reliability of the accelerator was shown to be greater than 90 percent at the 90 percent confidence level. The repeatability of the accelerator can be characterized by \pm 4 percent MSD of beam energy in the diode, \pm 2 percent MSD of mean electron energy in the diode, and \pm 8 percent MSD of average fluence at target location. Electron beams with areas in excess of 400 sq. cm., depths of penetration in excess of 0.6 gm²/sq. cm. and peak doses ranging from 25 to 100 cal/gm were characterized for future thermal structural response testing. 0 Refs.

Primary Keywords: Electron Beams; Thermal Structural Response Testing

4209
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Electrical; Gas Gaps; Electrical)
PARAMETERS AFFECTING FIRING TIME OF SIMULTANEOUSLY TRIGGERED TRIGATRON SPARK GAP SWITCHES

M.D. Williams
Langley Research Center, Hampton, VA
NASA Report No. NASA TN D-5077 (03/1969).
Availability: NASA-2088
NTIS

This report describes a technique and apparatus for spark gap research and presents the results of an investigation performed with that apparatus. The investigation was conducted primarily to determine how the variation of each of several spark gap parameters affects the firing-time differences (switch jitter) of simultaneously triggered trigatron spark gap switches. These parameters were switch voltage (15 to 20 kV), peak trigger voltage (14 to 20 kV), and the curvature of the edge of the trigger electrode hole. The firing times were measured using the light emitted from the switches. 5 Refs.

Primary Keywords: Trigatron Switch; Gap Voltage Variation; Trigger Voltage Variation; Curvature Of Trigger Hole; Experiment; Theory; High Switch Voltage

4210
(ENERGY STORAGE; INDUCTIVE)
(Systems)

PULSE POWER SYSTEMS EMPLOYING MAGNETIC ENERGY STORAGE
T.F. Trost
Texas Tech University, Lubbock, TX 79409
NSWC Final Report On Contract No. N60921-76-C-0092 (05/1977).
Availability: AD A039 897
NTIS

Several basic aspects of pulsed power systems supplying repetitive pulses and using inductive energy storage are investigated. These include the method of inductor charging, the efficiency of discharging with a resistive opening switch, the limitations of thermally driven resistors as triggering switches, the design of pulse forming networks for supplying resistive loads and the relative merits of voltage-fed versus current-fed networks, and some limitations on inductors. 22 Refs.

Primary Keywords: Inductive Energy Storage; Pulsed Power Systems

4212
(SWITCHES; CLOSING; SWITCHES; CLOSING; BREAKDOWN STUDIES)
(Gas Gaps; Optical; Systems; Gas; Optical)
SYMPATHETIC BREAKDOWN IN AIR

J.P. Brainerd and L.A. Andrews
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND77-1203 (08/1977).
Availability: SAND77-1203
NTIS

The breakdown of a spark gap by UV radiation from another spark gap is presented in this report. In this experiment, two air gaps were placed various distances apart. The behavior of the gaps under observation is studied with relation to a gap that is triggered by other means. The mechanism of breakdown in the gap under observation is found to be ultraviolet radiation from the control gap. 3 Refs.

Primary Keywords: Sympathetic Breakdown; UV Radiation; Medium Voltage

Secondary Keywords: Lightning Arrestor

4214

(BREAKDOWN STUDIES)
(Gas; Electrical)
THE STATISTICAL DISTRIBUTION OF VALUES OF BREAKDOWN VOLTAGE FOR AN AIR GAP

W.P. Baker
Electricity Council Research Centre, Copenhurst, UK
Electricity Council Research Report No. ECRC/M-1283 (09/1979).
Availability: ECRC M1283
NTIS

An analysis of 30,000 measurements of breakdown voltage on a spark gap removed from a surge diverter shows there to be a linear relation between normal probability and the logarithm of the excess of the applied voltage over a critical voltage. This linearity extended over more than six standard deviations. A statistical model is derived which agrees well with the experimental findings and which is investigated further to show that the physical parameter of the breakdown process in air which controls the scatter of test results is the rate of change of the first Townsend coefficient with field. 0 Refs.

Primary Keywords: Spark Gaps; Dielectric Breakdown; Foreign Technology; Percent Overvoltage; First Townsend Coefficient

6216
(INSULATION, MATERIAL)
(Gas)

BEHAVIOR OF AIR INSULATING GAPS OF DC SYSTEMS UNDER IMPULSE, DC AND COMPOSITE VOLTAGES

C. Menemenlis and G. Harbec
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-98, No. 6, pp 2065-2075 (12/1979).

This paper details with the behavior of air insulating gaps of direct current (DC) transmission systems in the voltage range of \pm 600 kV to \pm 20 kV. The gaps studied were simulating either a bipolar DC tower or a bipolar ring bus system. The influence of the terminations of the two ends of the insulator supporting the bus was investigated by using a single bus supported at one end. The breakdown voltage of the gaps was determined for a pure impulse, pure DC voltage or composite voltage formed by a DC on which an impulse was superimposed. The proximity effect of one pole on the pole-to-ground breakdown voltage of the other was also investigated. 7 Refs.

Primary Keywords: Air Insulating Gaps; \pm 600 kV To \pm 1200 kV Voltage Range; Impulse, DC, And Composite Test Voltages; Bipolar Buses; Rod-plane Breakdown Voltage; Terminating Electrodes

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

4342
(BREAKDOWN STUDIES)
(Lightning)

LABORATORY SIMULATION OF THE STEPPED LEADER IN LIGHTNING
H.M. Kekic and P. Savic
National Research Council, Ottawa, Ontario, Canada
Canadian Journal Of Physics, Vol. 54, pp 2216-2224 (07/1976).
The stepped leader in lightning was shown to be a relaxation oscillation phenomenon. The stepped leader was simulated by adding a parallel RC combination to the external circuit of a discharge gap. Experiments were also done in a well-preionized gas where there was no displacement current. 15 Refs.
Primary Keywords: Stepped Leader; Nonlinear Glow; Relaxation Oscillation; Simulation

COPYRIGHT: 1976 NATIONAL RESEARCH COUNCIL OF CANADA

4347
(SWITCHES; CLOSING; BREAKDOWN STUDIES)
(Liquid Gaps, Optical; Liquid, Electrical)

ON THE USE OF PERFLUOROPOLYETHER FLUIDS IN HV SPARK-GAPS
A. Luches and L. Provenzano
Universita di Lecce, Lecce, Italy
Journal Of Physics D: Applied Physics, Vol. 10, No. 3, pp 339-341 (02/1977).

Tests were performed to examine the dielectric properties of perfluoropolyether fluids (Fomblin Y) and their transparency to ultraviolet radiation. The purpose was to evaluate the advantage of their use in high-power spark-gaps, triggered by pulsed H_{\perp} lasers (5371 angstroms). Our results show that the perfluoropolyether fluids exhibit many advantages over the commonly used transformer oils. 1 Refs.
Primary Keywords: Perfluoropolyether Fluid; Nitrogen Laser Triggering; Self Healing; Fluid 'Aging'; Resistivity Measurement

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4348
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Voltage, Magnetic Field)

PERTURBATION OF THE STATIC VOLTAGE BREAKDOWN MECHANISM IN VACUUM BY A WEAK MAGNETIC FIELD

A. Watson
University of Western Ontario, London, Ontario, Canada
Canadian Journal Of Physics, Vol. 54, pp 2403-2417 (01/1976).
An analysis is presented of the effect of a weak magnetic field on the breakdown mechanism concentrating on the magneto-transport phenomena in a semiconducting field emitter. The geometry of a cathode protrusion is also considered. A new model of the breakdown mechanism is developed by altering the Fowler-Nordheim equation. A close agreement is found between predictions by this model and experimental results. 11 Refs.
Primary Keywords: Magnetic Field; Perturbation Of Breakdown Voltage; Field Emission; Poor Vacuum; Low Magnetic Field; Transverse Field; Copper Electrode

COPYRIGHT: 1976 NATIONAL RESEARCH COUNCIL OF CANADA

4358
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

A QUICK RESPONSE HIGH VOLTAGE DIVIDER
Y. Kubota, H. Kobayashi and A. Miyahara
Nagoya University, Nagoya, Japan
Japanese Journal Of Applied Physics, Vol. 15, No. 10, pp 2037-2038 (10/1976).

The authors describe a resistive voltage divider for use in a noisy pulsed power environment. The divider is constructed of a plexiglass tube filled with a copper sulphate solution. The divider employs a copper sulphate guard resistor for noise reduction. 2 Refs.
Primary Keywords: Resistive Voltage Divider; Guard Resistor; Copper Sulphate Solution; 2 MV Voltage Range

COPYRIGHT: 1976 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

4369
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas Gaps, Materials)

HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) AND ENVIRONMENTAL EFFECTS OF DIELECTRIC GASES
L.G. Christophorou, D.R. James, R.Y. Pei, R.A. Mathis, I. Seuers, L. Frees, M.O. Pace, D.W. Bouldin and C.C. Chan
Oak Ridge National Laboratory, Oak Ridge, TN 37830
ORNL Report No. ORNL/TH-7173 (01/1980).
Availability: ORNL/TH-7173 NTIS

A number of gas mixtures are suggested for industrial-scale testing. Electron attachment rates were measured and unfolded to give attachment cross section functions for several gases each in H_{\perp} , and for CCl_3 and CF_3 in Ar . The results of this study led to conclusions relating these parameters to molecular structure. Electron attachment rates were measured also for $n-C_6H_6$ and F_2 in both Ar and H_{\perp} . A study was made of the potential role for electron detachment in breakdown. The roles of several models of detachment was assessed, especially for SF_6 , N_2 and O_2 . The role of dipole scattering and electrons in inhibiting breakdown was investigated. The importance of large electron scattering cross sections at subexcitation energies was demonstrated, and means of realizing this with dipolar scattering were studied. The impulse measurements concentrated on $c-C_6H_6$, F_2 , N_2 and O_2 mixtures, which were found to be especially interesting under impulse conditions. Lightning and switching surges were used with a large point-plane gap as well as a sphere-sphere gap. In the practical conditions of cylindrical geometry with and without surface roughness, many multicomponent mixtures of the gases SF_6 , N_2 , $c-C_6H_6$, F_2 , N_2O , CO_2 and I_2 were tested, at both 1 and 4.4 atmosphere. 1 Ref.
Primary Keywords: Attachment Rate; Attachment Cross Section; Several Gases; Plane Electrodes; Parallel Electrodes; Sphere-Sphere Electrodes; Sensitivity To Field Nonuniformity

4374
(SWITCHES, CLOSING)
(Liquid Gaps, Electrical)

TIME-LAG CHARACTERISTICS OF A LIQUID TRIGATRON
J.L. Maksjajewski and J.H. Calderwood
University of Salford, Salford, UK
Journal Of Physics D: Applied Physics, Vol. 9, No. 17, pp L195-L198 (12/1976).

A study was made of the time-lag characteristics of a trigatron spark gap in n-hexane. The influence of the polarity of the triggering pulses and of the gap length was investigated. The significance of the results obtained is discussed. 2 Refs.
Primary Keywords: Trigatron; N-hexane; Polarity Effects; Variable Gap Spacing; Delay Measurements

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4377
(INSUL. 'ON' MATERIAL)
(Solid)

COMMENTS ON MANY-BODY DIELECTRIC RELAXATION IN SOLIDS

A.K. Jones, Jr., L.A. Dissado and R.M. Hill
Chelsea College, University of London, London, UK

Physica Status Solidi B, Vol. 102, No. 1 pp. 351-356 (11/1980).

This paper breaks with previously held views on dielectric relaxation based on non-interacting dipoles or charges and instead, develops a new one in terms of many-body phenomena. Disorder, occurring at three levels, is presented as a major factor in dielectrical polarization and thus is an important consideration in the model. The difference between large and small transitions is discussed along with what happens to the energy stored in a solid when the polarization is changed. 9 Refs.
Primary Keywords: Dielectric Relaxation; Many Body Interaction; Dipolar Transitions

COPYRIGHT: 1980 AKADEMIE-VERLAG

4379
(REVIEWS AND CONFERENCES; PARTICLE BEAMS, ELECTRON)

(Reviews; Reviews)
ELECTRON-BEAM-FUSION PROGRESS REPORT JANUARY-JUNE 1976

Authors Unknown

Sandia Labs, Albuquerque, NM 87115

Sandia Report No. SAND76-0410 (10/1976).

Availability: SAND76-0410 NTIS

This report presents an overview of the electron beam fusion program at Sandia Laboratories for 1976. Included are brief discussions of progress made in 1976 in switching, water insulated accelerators, Marx generators, water switches, vacuum interfaces, inductive energy storage systems, and magnetically insulated diodes and transmission lines. 90 Refs.
Primary Keywords: Switch Development; Particle Accelerator; Magnetic Insulation; Marx Generator; Inductive Energy Storage

Secondary Keywords: E-beam Fusion; Target Design; Plasma Diagnostics

4380
(REVIEWS AND CONFERENCES; PARTICLE BEAMS)

(Reviews; Reviews)
ELECTRON-BEAM-FUSION PROGRESS REPORT JULY THROUGH SEPTEMBER 1976

Authors Unknown

Sandia Labs, Albuquerque, NM 87115

Sandia Report No. SAND76-0711 (05/1977).

Availability: SAND76-0711 NTIS

This report presents an overview of the electron beam fusion program at Sandia Laboratories for 1976. Included are brief discussions of progress made in 1976 in switching, water insulated accelerators, Marx generators, water switches, vacuum interfaces, inductive energy storage systems, and magnetically insulated diodes and transmission lines. 94 Refs.
Primary Keywords: Marx Generator; Marx Trigger System; Water Capacitor; Transmission Line; Trigatron Gas Switch; Cold Cathode Diode

4381
(PULSE GENERATORS)

(Blumlein Lines)

A BLUMLEIN MODULATOR FOR A TIME-VARYING LOAD

S. Schneider, W.H.J. Wright and A.J. Buffa
ECOM, Fort Monmouth, NJ 07703

Technical Rep. No. ECOM-447, 14p (10/1976).

Availability: AD-A1035 102/35 NTIS

A modulator has been built to drive a time-varying impedance load. A Blumlein circuit, with two identical pulse forming networks, was used to produce an effective voltage of twice the charging voltage. A dissipative clamping circuit was included to simulate a well-behaved load. The switch is a 10 section iterative cavity-grid thyatron designed for 250 kilovolts (kV) and 20 kilampères (kA) peak current. The modulator has been operated at 210 kV at a repetition rate of a few hertz (Hz). (Author)

Primary Keywords: Modulators; Electronic Switches; Thyatrons; High Voltage; Electron Beams; Switching Circuits; Waveform Generators; Chemical Lasers; Deuterium; Pulse Generators

Secondary Keywords: Blumlein Circuits; High Energy Lasers; MT5DODXA

4382
(SWITCHES, CLOSING; SWITCHES, CLOSING)

(Gas Gaps, Electrical; Gas Gaps, Self)

FERRITE DECOUPLED CROWBAR SPARKGAP

R.C. Kunze, E.V. Mark, H. Wedler and G. Clement
Institut für Plasmaphysik, Garching, FRG

IPF Report No. IPF-4732 (04/1986).

Three crowbar sparkgaps are presented each with a different triggering mechanism. The first switch, tested for 8000 discharges on a 2.6 MJ bank, is triggered when the pulse voltage is 1.5 to 2 times the static breakdown voltage which can only occur when the electrodes are decoupled. The second, which also uses ferrite decoupling, is triggered without much jitter by a trigger pulse sent to a middle electrode which is at half potential. The third switch is also triggered by a middle electrode, but does not use ferrite decoupling. The trigger pulse applied to the middle electrode is sharpened allowing the gap to break down to both electrodes at the same time. 0 Refs.
Primary Keywords: Crowbar Gap; Ferrite Decoupling; Three Triggering Methods

- 4384**
(PARTICLE BEAMS; ELECTRON)
(Reviews)
ISSUES IN UNCLASSIFIED PARTICLE BEAM RESEARCH (PROCEEDINGS OF THE 1980 PARTICLE BEAM RESEARCH WORKSHOP)
B.D. Guenther (1), R. Lantz (1), J.L. Ray (2) and C.M. Stickley (3)
(1) US Army Research Office
(2) AFOSR, Bolling AFB, Washington, DC 20332
(3) BDM Corp, McLean, VA
Availability: AD A0 85158
NTIS
- This workshop is designed to define the important parameters relating to particle beam weapons that require further research. Important parameters in the aspect of pulsed power, charged particle sources, accelerators, propagation, and target interactions are presented, along with necessary research in each area. 0 Refs.
- Primary Keywords: Particle Beam; Electron Beam; Ion Beam
- 4385**
(REVIEWS AND CONFERENCES; PARTICLE BEAMS; ELECTRON)
(Reviews; Reviews)
LASER-FUSION AND ELECTRON-BEAM-FUSION RESEARCH PROGRESS REPORT JANUARY-JUNE 1974
E.H. Beckner, J.B. Gerardo and G. Yonas
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND74-0439 (C 1975).
Availability: SAND74-0439
NTIS
- This report presents an overview of the laser and electron beam fusion efforts at Sandia Laboratories for the period January-June 1974. Progress on multichannel and dielectric switching, inductive energy stores, self breaking water switching, Marx Generators, gas gap switching, and other topics is presented. 48 Refs.
- Primary Keywords: Switching; Marx Generator; Liquid Dielectric Switch; Gas Gap; Trigatron; Particle Beam Generation
- Secondary Keywords: E-beam Fusion; Laser Fusion; Plasma Diagnostics
- 4386**
(PARTICLE BEAMS; POWER CONDITIONING; SWITCHES; CLOSING)
(Reviews; Pulse Forming Lines; Gas Gaps; Optical)
PARTICLE BEAM FUSION PROGRESS REPORT APRIL 1978 THROUGH DECEMBER 1978
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND79-1011 (12/1979).
Availability: SAND79-1011
NTIS
- This report provides an overview of the particle beam fusion effort at Sandia Laboratories for the period of April-December 1978. Sections on vacuum diodes, analysis of magnetically insulated transmission lines, Marx generator development, laser and X-ray triggering of spark gaps, and power flow studies are included, as well as sections on plasma diagnostics and fusion target design and analysis. Rep-rated systems are briefly presented. 191 Refs.
- Primary Keywords: EBFA; Proto; E-beam; Marx Generator; Magnetic Insulation; Spark Gap; Power Flow; Resonant Transformer; Rep-rated
- Secondary Keywords: Particle Beam Fusion; Fusion Target; Plasma Diagnostics
- 4387**
(PARTICLE BEAMS; ELECTRON)
(Reviews)
PARTICLE BEAM WEAPONS-A TECHNICAL ASSESSMENT
G. Bekhti, B.T. Feld, J. Permentola and K. Tsipis
Massachusetts Institute of Technology, Cambridge, MA
Nature Vol. 289 pp. 219-225 (03/1980).
- The authors consider the use of a high energy particle beam as a weapon. The technical problems of generation, propagation, and interaction with a target are addressed. Several examples are given of possible missions that the particle beam could be used for, and the practical aspects of weapons targeting and control are discussed. Both endoatmospheric and exoatmospheric applications are examined. 34 Refs.
- Primary Keywords: Particle Beam Weapons; Generation; Propagation; Target Interaction; Beam Requirements
- Secondary Keywords: Orbiting Weapons
- COPYRIGHT: 1980 MACMILLAN JOURNALS LTD
- 4388**
(REVIEWS AND CONFERENCES)
(Reviews)
PULSED-POWER RESEARCH AND DEVELOPMENT IN THE USSR
S. Kessel
The Rand Corp, Santa Monica, CA 90406
ARPA Report No. R-2212-ARPA (05/1978).
Availability: AD A056635
NTIS
- The pulsed power work conducted in the Soviet Union from 1960 to 1978 is reviewed in this report. The organizational aspects, as well as the technical side of the open Soviet research is discussed in the areas of electron beam guns, linear and circular flux compression generators, inductive energy storage, homopolar generators, multipole generators, and opening and closing switches. The principal groups associated with each effort are identified with important results presented. 161 Refs.
- Primary Keywords: Flux Compression Generator; Inductive Energy Storage; Superconductivity; Homopolar Generator; Multipole Generator; MHD Generator; Switching
- 4389**
(PULSE GENERATORS)
(Capacitive)
AN IMPROVED METHOD OF TRIGGERING FLASHLAMPS POWERED FROM AN ENERGY STORAGE INDUCTOR
E.K. Inall
Australian National University, Canberra, Australia
Journal Of Physics E: Scientific Instruments, Vol. 9, No. 5, pp 213-215 (05/1976).
2 Refs.
- Primary Keywords: Pre-ionize Lamps; Series/parallel Lamps
- COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 4404**
(BREAKDOWN STUDIES; INSULATION; MATERIAL)
(Gas; Electrical; Gas)
SPARK-HOLD POTENTIALS AND IONISATION COEFFICIENTS IN SF/SUB 6/
V.N. Maller and M.S. Heidu
Indian Institute of Science, Bangalore, India
Proceedings Of The IEE, Vol. 123, No. 1, pp 107-108 (01/1976).
The authors present results of an experiment to determine the ionization coefficients of SF₆/sub 6/. A deviation from the Paschen Curve is pointed out at pd=1. Comparisons are made with the work of several other researchers. 12 Refs.
- Primary Keywords: SF₆/sub 6/; Gas; Townsend's Primary Coefficient; Townsend's Secondary Coefficient; Electron-attachment Coefficient
- COPYRIGHT:** 1976 IEE
- 4409**
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Optical; Gas Gaps; Optical)
USE OF A 'LASER SPARK' TO INITIATE A HIGH-POWER HIGH-PRESSURE GAS DISCHARGE
R.V. Mitin, V.I. Petrenko and Yu.L. Evetskii
Institute Of Engineering Physics, Academy of Sciences of the USSR, Khar'kov
High Temperature, Vol. 11, No. 6, pp 1026-1028 (12/1973).
Trans. From: Teplotekhnika Vysokikh Temperatur 11, 1147-1149 (November-December 1973)
- An investigation is made of the initiation of high-pressure discharges in argon using a 'laser spark.' An experimental determination has been made of the threshold breakdown electric field required for laser initiation of high-power gas discharges in argon at pressures up to 100 atm. 7 Refs.
- Primary Keywords: Argon Gas; 100 Atmosphere Pressure Range; Ruby Laser
- COPYRIGHT:** 1974 PLENUM PRESS, REPRINTED WITH PERMISSION
- 4410**
(PARTICLE BEAMS; ELECTRON; ENERGY STORAGE, INDUCTIVE)
(Generation; Systems)
HIGH-CURRENT, HIGH PULSE RATE ELECTRON ACCELERATOR WITH INDUCTIVE ENERGY STORAGE
V.I. Mikhailov and I.N. Sivikov
Soviet Physics-Technical Physics, Vol. 22, No. 6 pp. 703-705 (10/1975).
The characteristics of a high-current, high-voltage electron accelerator with inductive energy storage and the associated electron-optical system used for electron acceleration and current switching in a storage device are discussed. Accelerators of this kind can be efficient and relatively simple and provide pulse repetition frequencies above 100-200 Hz and at an average power of tens or hundreds of kilowatts. 6 Refs.
- Primary Keywords: Electron Accelerator; Inductive Energy Storage; Electron-Optical Switch
- COPYRIGHT:** 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 4411**
FLOATING DECK GRID MODULATOR
D.V. Savage
Hughes Aircraft Co, Fullerton, CA
Final technical rept. Mar 77-May 78 (10/1978).
Availability: AD A061 502/157
NTIS
- The all solid state Floating Deck Grid Modulator has been completed and successfully tested. The design goals of pulse width, pulse amplitude, duty cycle, operation in a 50 KV gradient and circuit survival during multiple crowsbars of the 50 KV power supply have been met. The rises and fall times are less than 700 nsec.
- (Author)
- Primary Keywords: Traveling Wave Tubes; Pulse Generators; Microwave Tubes; Tube Grids; Radar Transmitters; Pulse Duration Modulation; Pulse Amplitude Modulation; Pulse Transformers
- Secondary Keywords: Modulators; NTISDDDXA
- 4415**
(SWITCHES; CLOSING)
(Thyatron)
PLASMA CATHODE THYRATRON
D. Fleischner and D. Turnquist
EG&G Inc, Salem, MA 01970
ERACOM Report No. DELET-TR-77-2704-1 (09/1978).
Availability: AD A065048
NTIS
- The objective of this work is to provide a thyatron type device which is capable of cold-start operation; thus eliminating the need for standby power. A replica of a cold-cathode triode, described by Vagin in the Russian literature, was built and tested. The results do not support Vagin's description of its operation. A triode of our own design operates satisfactorily without filament power. A keep-alive or ignitor electrode is proposed as a solution to the high grid breakdown voltage and anode jitter found during the start-up period. 0 Refs.
- Primary Keywords: Gas Filled Tube; Switch Tube; Cold Cathode; Instant Start
- 4419**
(PULSE GENERATORS)
(Line Type)
GENERATOR OF HIGH VOLTAGE NANOSECOND PULSES WITH PRECISE LENGTH
P.S. Anan'tin, A.G. Sterilov, V.G. Tolmacheva and Yu.P. Usov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 4, pp 1115-1117 (08/1970).
Trans. From: Voprosy i Tekhnika Ekspertiz 4, 137-139 (July-August 1971).
- A method is described to decrease the amplitude of repeated pulses in a coaxial generator with a spark gap operating into a mismatched load. The length of the pulse on the load is set by a short-circuited section of coaxial cable, where the accuracy with which its length is measured determines the accuracy with which the length of the pulse on the load is set. The generator provides over control of the pulse amplitude from 5 to 15 KV, 0.5 nsec length of the front and trailing edge of the pulse on a matched load, and pulse length to 20 nsec when the amplitude of the repeated pulses is no greater than 5% of the amplitude of the basic pulse. The generator is designed to supply the electron optic shutter in an optic quantum generator. 5 Refs.
- Primary Keywords: Pulse Generator; Coaxial Line Energy Storage; Variable Pulse Length; Small Trailing Pulses
- COPYRIGHT:** 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

**4427
(PARTICLE BEAMS; ELECTRON)
(Generation)**

ANALYSIS OF COUPLING REGION IN TRANSMISSION-LINE ACCELERATORS
J.K. Tupperley
Army Ammunition Research and Development Command, Aberdeen Proving Ground
MD 21005
ARBLR Report No. ARBLR-TR-02120 (11/1978).
Availability: AD-A063663
NTIS

A Laplace-transform analysis is presented of an equivalent circuit which represents a pair of asymmetric transmission lines coupled through a reentrant discontinuity. This cavity configuration is applicable for transmission-line accelerator designs. General expressions for the time-dependent open-circuit output voltage are derived. Some numerical examples for specific line geometries are presented. 7 Refs.

Primary Keywords: Electron Accelerator; Transmission-line; Asymmetric Transmission-line Pairs; Reentrant Transmission-line Discontinuities; Laplace Transform

**4428
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)**

AN ELECTRO-OPTIC, HIGH-VOLTAGE, TRANSIENT PROBE
S.J. Posta and C.J. Michels
Lewis Research Center, Cleveland, OH
NASA Technical Memorandum Report No. 79019 (10/1978).
Availability: N79-12414
NTIS

A differential electro-optic voltage probe is described to measure transient differential high voltages in the range of 10 to 20 kV and 10 to 50 nsec. The probe was designed to measure the voltage applied to a laser and an electro-optic device, chosen to reduce noise and to minimize problems associated with ground loops in the circuit. Common mode rejection techniques were applied to the probe to reduce common mode noise. The probe consists of a LED with an input resistor which allows a current to flow in the LED that is proportional to the input voltage. The output of the LED is routed, via fiber optic to a remote photomultiplier and associated measuring equipment. A small bias is applied to the LED through a balanced network (to provide common mode rejection) to allow small reverse voltages to be measured. The probe was calibrated using a 2 kV pulser with a 1:10 step-up transformer for amplitude measurements and the same 2 kV pulser with a fast rise amplifier for the rise time measurements. The probe was found to be less noisy with better common mode rejection than the electrical probe used previously. 5 Refs.

Primary Keywords: Electro-optic Probe; Fast Rise; High Noise; Rejection; High Common Mode Rejection; Simple Design

**4429
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid; Electrical; Solid)**

A PROGRAMMABLE D-C HIGH-VOLTAGE RAMPED TEST SYSTEM FOR ELECTRICAL INSULATION

U. Milano
Bureau Of Reclamation, Denver, CO 80225
Bureau Of Reclamation Report No. REC ERC-78-7 (10/1978).
Availability: FD 290493
NTIS

A technique is presented that uses a programmable DC high-voltage test set to automatically ramp the high voltage at a preselected rate while continuously recording the resultant rotating machinery stator insulation current. The principal advantage of the ramp testing technique over the conventional stepped method is the greatly improved sensitivity and accuracy of the test results. In addition, the ramp test requires only one person to run the test and provides that person with better control and sufficient lead time when a failure point is approached to avoid damaging the insulation. A full description of the technique, interpretation of test results, and test set operation are included. 5 Refs.

Primary Keywords: Insulation Breakdown Strength; Ramp Test; Rotating Machine; Non-destructive Test

**4431
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)**

ONLINE DATA ACQUISITION SYSTEM FOR REPETITIVE PULSER DEVELOPMENT
M.T. Buttram
Sandia Labs, Albuquerque, NM 87115
(09/1978).

Availability: SAND 78-1751
NTIS

The computer system currently online to the RII-I, a one hundred pulse per second (pps), 200-kV pulser, is described. This system partially analyzes data as received to provide real-time, online diagnostic information about the performance of RII-I. The system is based on CAMAC, a set of conventions for the transfer of data between a computer and experimental modules. The computer for this facility is a PDP 11-34. The interface between computer and experimental modules is itself a microcomputer. A variety of experimental modules is used. The computer stores all incoming data on tape for subsequent complete analysis, if desired, performs a real-time partial analysis, and provides displays, as requested. The interface controls the transfer of data between experimental modules and the PDP 11 computer. The input modules were chosen to acquire a few digital words per pulse which, when collected into statistical ensembles, characterize RII-I operation. Time digitizers and analog-to-digital converters are currently being used. The system has the capability of providing active computer control should that become desirable. 14 figures, 6 tables. (RAA citation 04 016975)

Primary Keywords: Beam Pulses; Electrosynthetic Accelerators; High Voltage Pulse Generators; Ion Accelerators; Data Acquisition Systems; Electronics; Fortran; On-Line Measurement Systems; Pdp Computers

Secondary Keywords: EPDA/416300; NTIS/DT

**4434
(BREAKDOWN STUDIES)
TRIGGERING OF A HIGH VOLTAGE PULSE SHAPER FOR IMPROVING TIME STABILITY AND AMPLITUDE STABILITY**

K. Detters, G. Peter, A.F. Schurz, K. Trutzbachler and Y.V. Grishkevich
Deutsche Akademie der Wissenschaften zu Berlin, Zentralinstitut für Physik
(01/1978).

Availability: PHE-78-15
NTIS

Triggering of a transformer-powered Blumlein line with a $R_{\text{sub}}/2$ -load and a triac-pair trigger is described. Stability of the amplitude of delta U/R is analyzed. Advantages and disadvantages of both methods are discussed. (Atomindex citation 09 39668)

Primary Keywords: High Voltage Pulse Generators; Pulse Spark Chambers; Amplifiers; Pulse Pulse Rise Time; Pulse Shapers; Stability; Trigger Circuits

Secondary Keywords: Delta U/R; Triac; Blumlein Line; Resistors; Diodes

**4440
(SWITCHES; CLOSING)
(Gas Gaps; Optical)**

A MULTICHANNEL LASER TRIGGERED SPARK GAP WITH SUBNANOSECOND RISETIME FOR ELECTRO OPTIC SWITCHING
C.L.M. Ireland
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK

Journal of Physics C, Vol. 8, pp 1007-1010 (07/1975).
The construction and some of the operating characteristics of a multichannel laser triggered spark gap (LTSG) are described. Simultaneous subnanosecond switching of five channels of up to 10 kV is possible, making the LTSG an ideal master switch for pulsing Pockel cells to control the pulse shape and isolation necessary in a large laser oscillator-amplifier system. Operated under $M_{\text{sub}}/2$ at a pressure of approximately 10 torr, the LTSG had a rise time <300 ps and used in conjunction with a fast Pockel cell switch could shutter reliably optical pulses of <500 ps duration from the output of a Q-switched laser. The results indicate that at higher pressure the rise time of the LTSG should be further reduced allowing switching in approximately 100 ps to be achieved. 11 Refs.

Primary Keywords: Coaxial Spark Gap; Nitrogen Gap; Variable Pressure; Multichannel Operations; Five Channels; 300 Picosecond Rise Time; High Pressure Gap

COPYRIGHT: 1975 INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**4444
(SWITCHES; CLOSING)
(Gas Gaps; Electrical)**

A THREE GAP SPARK DISCHARGE DEVICE FOR SUPPLYING SPARK CHAMBERS
G.D. Alekseev and D.M. Khavin
Joint Institute of Nuclear Research, Dubna, USSR
Instruments And Experimental Techniques, Vol. 18, No. 5, pp 1447-1449 (10/1975).

Trans. From: Pribory i Tekhnika Eksperimenta 5, 105-106 (September-October 1975)

A three-gap air spark-discharge device was investigated. The device is efficient over a wide range of supply voltages, it has an actuation delay of 30 to 60 nsec, depending on the supply voltage; the scatter of the delay is 7-15 nsec, the duration of the leading edge of the output pulse is approximately 10 nsec. The spark-discharge device is reliable in operation, has a long service life, and is simple to fabricate. 5 Refs.

Primary Keywords: Spark Gap; Air Gap; Self-crowbarring; 7-15 ns Jitter; Long Life; Low Current

COPYRIGHT: 1976 PLenum Press, REPRINTED WITH PERMISSION

**4456
(INSULATION, MATERIAL)
(Solid)**

DISTRIBUTION OF SURFACE CHARGES ON PERSPEX DUE TO PARTIAL DISCHARGES
S. Indravelli and V. Prahashankar
Indian Institute of Science, Bangalore, India
Journal of Physics D: Applied Physics, Vol. 9, No. 6, pp 987-997 (04/1976).

11 Refs.

Primary Keywords: Perspex; Air Insulation; Partial Discharge; Corona Discharge; Surface Tracking; Puncture

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**4460
(BREAKDOWN STUDIES)
(Electrodes)**

EROSION OF METAL CATHODES BY ARCS AND BREAKDOWNS IN VACUUM
E. Hantsche (1), R. Juttner (1), V.F. Puchkerov (2), W. Rohrbeck (1)
and H. Wolff (1)

(1) Akademie Der Wissenschaften Der DDR, Zentralinstitut Fur Elektrotechnikphysik, Berlin, DDR.
(2) Siberian Department Of The Academy Of Science Of The USSR, Tomsk, USSR

Journal of Physics D: Applied Physics, Vol. 9, No. 12, pp 1771-1781 (04/1976).

19 Refs.

Primary Keywords: Metal Cathodes; Erosion Structure; Nanosecond Breakdown; Quasi-stationary Arcs; Crater formation Types; Micropoint Explosions; Cathode Spots; Field-emission; Ion Pressure

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**4474
(BREAKDOWN STUDIES)
(Gas; Electrical)**

INFLUENCE OF RAIN ON SWITCHING IMPULSE SPARKOVER VOLTAGE OF LARGE-ELLIPTIC AIR GAPS

E.A.M. Rizk
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions on Power Apparatus And Systems, Vol. PAS-95, No. 4, pp 1534-1542 (08/1976).

An investigation with a laboratory investigation into the influence of rain on the switching impulse sparkover characteristics of large sphere and forced plane air gaps. Tests were also carried out on cone terminated rod plane gaps for reference purposes. The factors investigated include the high voltage electrode geometry, nature of the surface, rain intensity as well as the impulse form and polarity. Attention is also paid to the influence of rain on the statistical dispersion of the sparkover voltage and on the nature of the cumulative probability curve. A general correlation, valid for a wide variety of electrodes, has been established between the mean sparkover voltage gradient for positive switching impulses under dry conditions, and the corresponding influence of rain on the breakdown voltage. 19 Refs.

Primary Keywords: Humidity Influence; Air Gap; Sphere-sphere Gap; Large Elliptical Plane Gap; Geometry Effects

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

**4481
(BREAKDOWN STUDIES)
(Surface Flashover)**

ON THE CONDITIONING PHENOMENA OF SURFACE FLASHOVER OF EPOXY RESINS IN A VACUUM
Y. Okai and K. Yamaji
Waseda University, Tokyo, Japan
Japanese Journal of Applied Physics, Vol. 15, No. 1, pp 177-178 (01/1976).

Experiments were done which studied the flashover of epoxy resins in a vacuum. Conditioning effects were noted with the epoxy resin dielectric and without it. Seven types of resin were used so that the effect of the hexane ring on breakdown voltage could be examined. 5 Refs.

Primary Keywords: Surface Flashover; Conditioning; Electrode Effect; Several Samples; Similar Behavior

COPYRIGHT: 1976 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

4489
(PULSE GENERATORS; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)
(Systems; Pulse Transformers; Generation)
RELATIVISTIC ELECTRON BEAM SOURCE WITH AN AIR-CORE STEP-UP TRANSFORMER
A. Mohri, K. Ikuta, M. Masuzaki, T. Suzuki, S. Fujiwara, K. Ukegawa
and T. Kata
Nagoya University, Nagoya, Japan
Japanese Journal of Applied Physics, Vol. 14, No. 11, pp 1777-1781
(11/1975).

A design for a high current relativistic electron beam source using an air-core step-up transformer is presented. The step-up ratio was greater than 10 and the energy transfer efficiency from the capacitor bank to the pulse forming line was 43%. The machine proved to be reliable as it required little maintenance during the 5000 times it was operated without major trouble. 13 Refs.

Primary Keywords: Vacuum Diode; Marx Generator; Pulse Transformer;
Pulse Forming Line; Impedance Conversion

COPYRIGHT: 1975 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

4492
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
STARTING CHARACTERISTICS OF A 100-KV TRIGATRON FILLED WITH SF₆/SUB 6/
A.I. Gerasimov, G.D. Kulishov, A.I. Pavlovskii, S.Ya. Sylyusarenko and
A.S. Fedotkin
Instruments And Experimental Techniques, Vol. 18, No. 5, pp 1435-1437
(10/1975).
Trans. From: *Priobry i Tekhnika Eksperimenta* 5, 111-113
(September-October 1975)

An experimental investigation was made of the delay and scatter of the time required to turn on a trigatron as a function of the polarity of the high-voltage electrode and of the control-voltage pulse, on the amplitude of the pulse, and on the SF₆/SUB 6% pressure. The distance between the main trigatron electrodes is 7 mm; the diameter of the control electrode is 2 mm; the annular gap between the control electrode and the main electrode which encompasses it is 2.5 mm. It is shown that for a negative potential of the high-voltage electrode and a positive starting pulse, the scatter of the actuation time delay does not exceed 1 ns in the range of pressure variations from the value corresponding to uncontrollable breakdown at 100 kV up to a pressure five times as great (15 atm). 1 Refs.

Primary Keywords: Trigatron; SF₆/SUB 6% Gap; Switching Delay; Both
Polarities; Variable Gas Pressure; Variable Trigger
Voltage; 100 kV Operating Voltage

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

4501
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
UV LASER TRIGGERING OF SPARK GAPS BY TWO-QUANTUM PHOTOELECTRIC EFFECT
K. Heinecke, H. Lippmann and H. Strubhaar
University of Stuttgart, Stuttgart, FRG
Physics Letters, Vol. 55A, No. 3, pp 153-154 (12/1975).

A nitrogen laser is utilized to irradiate an aluminum cathode in an attempt to isolate the ionization mechanism of UV laser triggering of spark gaps. Two mechanisms considered are Richardson emission and photoelectric emission. The gap was evacuated during the study to prevent breakdown, enabling study of the electron emission from the cathode in detail. The authors present evidence for two photon photoelectric emission of electrons from the cathode as the primary triggering mechanism. 6 Refs.

Primary Keywords: Nitrogen Laser; Aluminum Cathode; Richardson Effect;
Photoelectric Emission; Two-photon Effect; Spark
Gap; Vacuum Gap

COPYRIGHT: 1975 NORTH HOLLAND PUBLISHING COMPANY

4530
(POWER CONDITIONING)
(Pulse Forming Networks)
SCEPTE MODELS OF A PULSE FORMING SYSTEM
R.J. Kuhler and V.J. Watson
University of Kentucky, Lexington, KY 40506
RADC Report No. RADC-TR-75-69 (03/1975).

Availability: AD A009175
NTIS

Work performed in the generation and testing of the pulse forming network SCEPTE model is discussed with emphasis upon attempts to determine the pulse forming network element stressing factors under conditions of specific fault occurrences: pulse transformer failure via secondary short, load port secondary open, and pulse forming network capacitance short. When the pulse forming model is available, the composite system can be simulated to determine the result of transient and fault conditions on the overall network operation. 0 Refs.

Primary Keywords: Pulse Forming Network; SCEPTE Computer Code; Fault
Modeling; Electromagnetic Compatibility

4537
THE VEBA RELATIVISTIC ELECTRON ACCELERATOR
R.K. Parker and R.W. Ury
Naval Research Lab., Washington, DC 20375
Interior rept. No. NRL-MR-3056, 19p (05/1975).
Availability: AD-A013 188/857
NTIS

The VEBA high-current, relativistic electron accelerator has been designed and constructed at NRL for application in the study of high power microwave sources. To meet the requirements of this study, the accelerator was designed for operation in either a short (60 nsec) or long (2.2 microsec) pulse mode. The pulse-forming network in the short-pulse mode is an unbalanced Water Blumlein with an output impedance of 9.1 ohms. The Blumlein is pulse-charged by a 1.9 MV Marx generator which has a series capacitance of 28 nF. By transmission along a tapered coaxial line, the output pulse is transformed to a 20 ohm load. A voltage developed across the load is increased to 1 MV. The Blumlein and transformer sections are removed to connect to the long pulse mode, and the diode is attached directly to the oversized Marx tank. The direct coupling between the Marx and the Blumlein is then replaced by two, nested, water capacitors which are shunted by spiral inductors. This unit with the Marx forms a three-section, voltage-fed, Guillemin (type A), pulse-forming network with a characteristic impedance of 40 ohms and an output voltage of 1 MV.

Primary Keywords: Electron Accelerators; Microwaves; Pulse Generators;

Diodes; Sources

Secondary Keywords: NTISDDNR

4540
(ENERGY CONVERSION, ELECTRICAL; INSULATION, MATERIAL)
(Power Supplies; Liquid)
A HIGH-VOLTAGE SOURCE WITH DIGITAL CONTROL FOR DIELECTRIC MEASUREMENTS
A.R. Reinert, G.M. Rhodes and J.E. Brignell
City University, London, ECI, UK
Journal of Physics E: Scientific Instruments, Vol. 5, pp 587-590
(06/1972).

An improvement in the rigorous control of high voltages for dielectric measurements is achieved by employing digital techniques in the development of a low-voltage controller for a generator of either the oscillator or electrostatic type. Principal advantages over a method previously described are the provision of a highly stable hold mode and the capability for very slow rates of voltage application. Comprehensive logic controls, incorporating essential safety features, allow fully automatic experiments to be performed, and a flexible design permits a simple addition to the equipment to increase the resolution if desired. 6 Refs.

Primary Keywords: Insulation Tester; Ramp Voltage Generator; Digital
Control; High Voltage Accuracy

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4547
(SWITCHES, CLOSING)
(Liquid Gaps, Optical)
A HIGH-VOLTAGE WATER SPARK GAP WITH LASER FIRING
B.A. Demidov, V.V. Ivkin, V.A. Petrov and S.D. Fanchenko
Instruments And Experimental Techniques, Vol. 17, pp 131-133 (02/1974).
Trans. From: *Priobry i Tekhnika Eksperimenta* 1, 120-122
(January-February 1974)

The possibility is investigated of initiating high-voltage breakdown of distilled water in a spark gap by means of a spark from a delayed pulsed laser. Up to 100 MV at 100 Hz it is shown that for focusing of laser radiation onto the positive, charge electrode the scatter of the actuation time of the spark gap amounts to several nanoseconds. A spark gap construction was proposed which ensures reliable firing of the discharge for any polarity of the voltage across the electrodes. 6 Refs.

Primary Keywords: Nd Laser; Polarity Effects; Several Nanosecond Jitter

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

4552
(PULSE GENERATORS; BREAKDOWN STUDIES)
(Marx; Vacuum, Electrical)
A 2-MV PULSED ELECTROVACUUM INSTALLATION
J.I. Kalyatskii, G.M. Kassirov and G.V. Smirnov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 4, pp 1032-1034
(08/1974).
Trans. From: *Priobry i Tekhnika Eksperimenta* 1, 84-86 (July-August 1974)

An experimental installation is described for investigating electrical breakdown in a vacuum of up to 1E-5 Torr at pulse voltages of up to 2 MV. The length of the vacuum gap reaches 16 cm. 4 Refs.

Primary Keywords: Vacuum Breakdown Study; Apparatus Description;
Experimental Results; Aluminum Electrodes; Sphere-plane Gap

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

4565
(PARTICLE BEAMS, MACRO; BREAKDOWN STUDIES)
(Generation; Vacuum, Particles)
MICROPARTICLE ENERGY ENHANCEMENT FOLLOWING A BOUNCING IMPACT IN A
HIGH-VOLTAGE GAP

A.S. Brah and R.V. Letham
University of Aston, Birmingham, Birmingham B4 7ET, UK
Journal of Physics D: Applied Physics, Vol. 8, No. 8, pp L109-L111
(06/1975).

A low-velocity microparticle gun has been developed for a controlled study of the momentum and charge reversal associated with particle bouncing in a high-voltage vacuum gap for impact velocities of 5-200 m/s. It has been demonstrated that there are a range of experimental conditions for which this mechanism can lead to an enhancement in the kinetic energy of a microparticle. This observation has used a supporting multi-transit model for the initiation of electrical breakdown by the impact of microparticles having velocities in excess of 1500 m/s. 12 Refs.

Primary Keywords: Microparticle; Acceleration; Momentum Transfer;
Charge Reversal; Vacuum Breakdown; Multi-transit
Model

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4570
(PARTICLE BEAMS, ELECTRON; POWER CONDITIONING; PULSE GENERATORS)
(Generation; Pulse Transformers, Systems)
RESONANT TRANSFORMER ELECTRON BEAM PULSER
J.J. Moriarty
Energy Sciences Inc., Burlington, MA 01803
AFWL Report No. AFWL-TR-74-122 (11/1974).
Availability: AD-A001628
NTIS

A resonant air-core transformer has been evaluated theoretically and experimentally as a pulser for an electron beam gun. The analysis has resulted in a set of design parameters which has been used to design a lightweight (approximately 100 kg) pulser for the generation of 150 kV, 40-A pulses of 30 microsecond duration at 250 pps in 10-sec bursts. An experimental model has generated 150-kV, 2 to 5-A pulses of 10 to 14 microsecond duration at 20 pps in operation limited by the available power supply. Experimental results have been in sufficient agreement with the theory to provide a high level of confidence in the full scale design. The efficiency predicted in the simplified case of decoupled losses varies from 42 percent with respect to charging to 58 percent by reactive charging methods. In general, the D-to-beam efficiency improves as the loading is increased and may approach 68 percent in view of the coupling which realistically exists between loss elements. 7 Refs.

Primary Keywords: Resonant Air-core Pulse Transformer; E-beam
Generation; Light Weight; Rep-rated; Experiment;
Theory; Design Considerations

4572
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)
(Generation; Systems)
SHAPING OF VOLTAGE PULSES BY DISCHARGING AN INDUCTIVE STORAGE BANK WITH A CHARGED-PARTICLE BEAM
D.A. Gusev, E.G. Komov, V.B. Markov and E.M. Melikh
Soviet Phys.: Technical Physics, Vol. 19, No. 5, pp 662-663 (11/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1051-1054 (May 1974).
Calculations and experimental data are reported on the conditions for the formation of a rectangular accelerating-voltage pulse in a direct-action charged-particle accelerator in which energy is supplied from an inductive bank. 2 Refs.
Primary Keywords: E-beam Generation; Inductive Energy Store; Matching Condition; Current Regulation; Impedance Calculation
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4581
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Materials)
THE RECOVERY OF HIGH CURRENT LONG GAPS IN HYDROGEN AND ARGON
R. Simons and A.B. Parker
University of Liverpool, Liverpool, UK
International Journal of Electronics, Vol. 37, No. 6, pp 825-832 (11/1974).
Dielectric recovery voltages of high current long gaps (8 cm) in hydrogen and argon are investigated. Temperature profile of the gap is given along with values of temperature versus time. Recovery curves calculated from measurements were found to differ greatly from derived recovery curves. Explanations for the differences are discussed. 11 Refs.
Primary Keywords: Spark Channel Recovery; Argon; Hydrogen; Temporal Variation Of Temperature; Radial Variation Of Temperature
COPYRIGHT: 1974 TAYLOR S. FRANCIS LTD

4590
(SWITCHES, CLOSING)
(Gas Gaps, Optical)
A DYE LASER TRIGGERED SPARK GAP
K. Schildbach and D. Basting
Max-Planck-Institut für Biophysikalische Chemie, Göttingen, BDR, Germany
The Review of Scientific Instruments, Vol. 45, No. 8, pp 1015-1016 (08/1974).
Performance of a dye laser triggered spark gap is described with a triggering threshold of only 2 kV peak power and 5 microjoules pulse energy. This spark gap is used as a switching element in a nitrogen laser resulting in a delay between dye laser and nitrogen laser emission of only 20 nsec and a subnanosecond jitter. 5 Refs.
Primary Keywords: Dye Laser; Low Power; Very Low Energy; Tungsten Electrode; Subnanosecond Jitter
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4592
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A PICOSECOND RISETIME HIGH VOLTAGE DIVIDER
D.G. Pellingen (1), G. Johnson (2) and A. Mitchell (2)
(1) Physics International Co., San Leandro, CA 94577
(2) Lawrence Livermore Lab., Livermore, CA 94550
The Review of Scientific Instruments, Vol. 45, No. 7, pp 944-946 (07/1974).
A two-stage voltage divider having a voltage measuring capability on the order of 100 kV and a rise time of 250 psec has been used to measure submicrosecond pulses on a pulsed electron accelerator. The divider uses a copper sulphate solution high-voltage divider, and a secondary divider made of carbon composition resistors. Measurements have been made indicating that the solution divider is useful with fields of 30 kV/cm and with subnanosecond rise times. 4 Refs.
Primary Keywords: Two-stage Voltage Divider; Resistive Divider; Copper Sulphate Resistor; Carbon Resistor; 100 kV Vc Edge Rate; 250 ps Rise Time
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4593
(SWITCHES, CLOSING)
(Vacuum Gaps, Optical)
A VACUUM SPARK GAP WITH LASER FIRING
A.A. Malkinovich and V.A. Rodchkin
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1716-1717 (12/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 90-91 (November-December 1973).
A vacuum (approximate 1E6-1E13 Torr) spark gap operating at a voltage of up to 50 kV is described which is fired by a switched ruby laser. The time delay of spark-gap breakdown was measured at various computed voltages, various pressures, and different polarities of the target electrode. The possibility of using the spark gap in circuits for shaping nanosecond pulses is evaluated. 3 Refs.
Primary Keywords: Ruby Laser; 50 kV Voltage Range; Time Delay Measurement; Plane Electrodes; Nanosecond Jitter
COPYRIGHT: 1974 PLenum Press, REPRINTED WITH PERMISSION

4626
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
MEASUREMENT OF A HIGH VOLTAGE BY A ROTOR VOLTmeter USING AN INSULATED ELECTRODE
M.T. Novikov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1591-1592 (10/1973).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 247-248 (September-October 1973).
The possibility and singularities of the measurement of a high voltage by a rotor voltmeter when the electric field from the high-voltage electrode is brought out to the voltmeter by means of an insulated measuring electrode is discussed experimentally. The measurements were carried out at voltages of 0 to 50 kV. 2 Refs.
Primary Keywords: Rotor Voltmeter; DC Voltage Measurement; 50 kV Operating Voltage; High Reliability
COPYRIGHT: 1974 PLenum Press, REPRINTED WITH PERMISSION

4640
(PARTICLE BEAMS, ELECTRON)
(Generation)
ION-INDUCED PINCH AND THE ENHANCEMENT OF ION CURRENT BY PINCHED ELECTRON FLOW IN RELATIVISTIC DIODES
S.A. Goldstein (1) and R. Lee (2)
(1) University of Maryland, College Park, MD 20742
(2) Naval Research Lab., Washington, DC 20375
Physical Review Letters, Vol. 33, No. 16, pp 1079-1082 (10/1975).
A new model for time-dependent and steady-state ion and electron flow in large-aspect-ratio diodes is constructed. The electron trajectories are computed with use of the self-consistent fields calculated during the initial ion motion. The dynamic formation of a tightly pinched electron flow is qualitatively explained. Very large ion currents, nearly equal to the electron current, are predicted for flat solid cathodes. When steady-state flow is achieved, 8 Refs.
Primary Keywords: E-beam Generation; Large Aspect Ratio Diode; Flat Solid Cathode; Ion Current; Electron Current; Pinched Electron Flow
COPYRIGHT: 1975 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

4641
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
ROTARY SPARK GAP SWITCHING FOR HIGH POWER DYE LASERS
C.M. Ferrer
United Aircraft Research Labs, East Hartford, CT 06108
Applied Optics, Vol. 13, No. 9, pp 1998-1999 (09/1974).
A rotary spark gap is used in series with a flashlamp to provide the necessary voltage holdoff between pulses. The gap was tested up to 150 pps with the flashlamp pumped dye laser reaching a maximum output of 39W at 110 pps. Possible gap improvements are discussed. 5 Refs.
Primary Keywords: Rotary Spark Gap; Rep-rate; Short Recovery Time; High Gap Inductance
Secondary Keywords: Dye Laser Pumping
COPYRIGHT: 1974 OPTICAL SOCIETY OF AMERICA, INC.

4644
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SIMPLE SPARK GAP FOR A HIGH REPETITION RATE NITROGEN LASER
L. Pallaro, R. Pollicini and F. Zaraga
Lab di Fresica dei Plasme ed Elettronica Quantistica del CNR, Milan, Italy
Optics And Laser Technology, Vol. 6, No. 4, pp 1 (03/1974).
A simple and inexpensive 30 kV spark gap capable of repetition rates up to 100 Hz is presented. It uses, among other things, the terminal external part of a spark plug of a car as the trigger electrode. 3 Refs.
Primary Keywords: Spark Gap; Simple Design; Medium Voltage; High Reliability; Rep-rate
COPYRIGHT: 1974 IPC BUSINESS PRESS LTD.

4660
(BREAKDOWN STUDIES)
(Gas, Electrical)
VARIATION OF ION DENSITY IN A HIGH-VOLTAGE LABORATORY DURING IMPULSE-VOLTAGE TESTING
T.E. Allibone and D. Dring
Leeds University, Leeds, UK
Proceedings Of The IEEE, Vol. 121, No. 5, pp 401-402 (05/1974).
The variation of ion density in the vicinity of a gas breakdown gap with and without stabilizing radiation is described. The time of decay to background level is reported, as well as effects of nearby high-voltage equipment. 5 Refs.
Primary Keywords: Ambient Ionization Level; Radiation; DC Voltage; Impulse Voltage; Decay Time
COPYRIGHT: 1974 IEEE

4679
(REVIEWS AND CONFERENCES)
(Conferences)
1976 IEEE PULSED POWER CONFERENCE PROCEEDINGS
Conference Report (11/1976).
This conference record contains 97 papers (9 are included as abstracts only), all of which are referenced individually in the bibliography. Topics include energy storage, pulse generation, pulse shaping, switching, particle beam generation, beam transport, applications, and reviews of the state-of-the-art. 0 Refs.
Primary Keywords: Energy Storage; Pulse Generation; Pulse Shaping; Switching; Particle Beam Generation And Transport; Applications
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4680
(PULSE GENERATORS; ENERGY CONVERSION, ELECTRICAL)
(Line Type; Charging Circuits)
AN AMENDED LINE-TYPE PULSE GENERATOR CIRCUIT
G. Scopes
English Electric Valve Co Ltd, Chelmsford, Essex, UK
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-6 (11/1976).
Over the years line-type pulse generators have tended to become standardised and in the majority of modern circuits a pulse forming network is charged directly to a relatively low voltage and then discharged into a substantially matched load to generate an output pulse. The variant described in this paper is similar, except that instead of connecting one terminal of the load to the common negative busbar, it is connected to the high tension terminal of the capacitor forming the reservoir of the power supply. This halves the voltage to which the PFN is charged and several advantages accrue from this change. These are, in a few cases, offset by the use of a floating load, although a correctly designed pulse transformer largely obviates this. The advantages and disadvantages of the circuit are discussed, showing that in many applications its use results in lower capital cost and more certain recovery of the switching device. 0 Refs.
Primary Keywords: Line Type Pulse Generator; PFN Charging Method
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4681
(ENERGY STORAGE; MECHANICAL; PULSE GENERATORS)
(Rotating Machines; Rotating Machines)
AN ELECTROMECHANICAL PULSE GENERATOR

J.P. Craig and R. Seeks
Texas Tech University, Lubbock, TX 79409

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-7 (11/1976).
A prime pole generator has been conceived and designed and a low power model has been built and tested. The machine produces one large positive pulse per revolution and a number of small, equal magnitude negative pulses per revolution depending upon the number of poles. Any prime number of poles can be used, with one zero-strength pole and an equal number of equal strength north and south poles. The pole pattern can be determined from a Legendre Sequence. 0 Refs.

Primary Keywords: Prime Pole Generator; Rep-rate; Legendre Sequence

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4682
(ENERGY STORAGE, CAPACITIVE)
(Systems)

A DESIGN APPROACH TO A REPETITIVELY PULSED SUPER FAST CAPACITOR BANK
D. Zucker (1), J. Long (1) and W. Bostick (2)
(1) Lawrence Livermore Lab., Livermore, CA 94550
(2) Sandia Institute of Technology, Hoboken, NJ 07030

1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-4 (11/1976).
Repetitively pulsed super fast banks suffer from the following problem: On the one hand, long life necessitates low fields. On the other hand, high fields are necessary to shrink down the volume of the total system and thus, the inductance. Here we are describing an approach that tries to optimize as much as possible, these two conflicting requirements in a design for a megajoule capacitor bank capable of pulsing ten million shots or above, at a minimum of one pulse a second. Problems such as current crowding in the capacitor bank, switching, heat removal, pointing vector flux surface to volume considerations, energy recycling and foil design will all be presented. Specific design parameters and final dimensions will be presented.

Primary Keywords: Super Fast Capacitor Banks; Long Life; Low Inductance

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4683
(POWER CONDITIONING)
(Pulse Forming Networks)

A HALF MEGAWATT PULSE FORMING NETWORK
J.E. Creedon (1) and R.A. Fitch (2)

(1) ECOM, Fort Monmouth, NJ 07703

(2) Maxwell Labs Inc, San Diego, CA 92123

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-1 (11/1976).
A lightweight half megawatt average power pulse forming network designed to store 4 kilojoules at 40 kilovolts has been developed. The energy storage system produces a 10 microsecond pulse at a repetition rate of 125 hertz and has a one ohm impedance. It is designed to operate adiabatically for durations of 60 seconds. A lifetime capability of over 465 pulses has been demonstrated. 0 Refs.

Primary Keywords: Pulse Forming Network; Rep-rate; Burst Mode; High

Average Power; Adiabatic Operation

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4684
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

A HIGH VOLTAGE D-C REGULATOR SYSTEM PERFORMANCE PREDICTION TECHNIQUE

C.J. Eichstaedt, Jr.
General Electric Co, Syracuse, NY 13201

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-6 (11/1976).
The DC beam accelerating voltage applied between the cathode and the slow wave structure of a traveling wave amplifier tube must often be held to within a few hundredths of one percent of its specified value if acceptable R-F phase stability is to be obtained from the amplifier. In high power pulsed radar applications this d-c voltage may be on the order of 40 kilovolts, hence the requirement for a precisely controlled high voltage regulated power supply with excellent transient response typically results. Since the construction of a breadboard model of such a system is usually impractical from both schedule and cost points of view, a reliable means of analytical performance prediction is of considerable importance. The CIRCUIT 2 computer aided design program was used for this analysis. The techniques described are equally applicable to many current requirements, for example, neutral beam pulse regulator systems. 0 Refs.

Primary Keywords: Excellent Voltage Regulation; Good Transient Response; Analysis; Design Considerations

Secondary Keywords: Travelling Wave Tube

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4685
(POWER CONDITIONING)
(Saturable Reactors)

A PULSE COMPRESSION NETWORK

O. Zucker
Lawrence Livermore Lab, Livermore, CA 94550

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-8 (11/1976).
Classic pulse compression networks are typically of the Melville line type. These types of compression networks are characterized by resonance transients, energy loss, identical capacitors through successively smaller inductors. These stages are isolated by switches which in the case of the Melville line are integrated into the inductor by the use of saturable magnetic cores. The reduced inductance reduces the ringing frequency and the impedance. In this paper we discuss a novel compression circuit which utilizes both saturable capacitors and saturable inductors with the resulting improvement in both compression per stage and impedance control. Some basic calculations and practical limitations of the compressor will be discussed. 0 Refs.

Primary Keywords: Pulse Compression Technique; Saturable Inductor

Secondary Keywords: Abstract Only

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4686
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Systems; LC)

A 3 MA, 600 KV FAST CAPACITOR BANK FOR A SHOCK-HEATED TORUS
D. Markins (1), Y.G. Chen (2), C. Chin-Fatt (2) and A. DaSilva (2)

(1) Maxwell Labs Inc, San Diego, CA 92123

(2) University of Maryland, College Park, MD 20742

1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-3 (11/1976).

A high-beta, toroidal discharge is shock-heated by a hexagonal array of low-inductance, synchronized pulser modules. The toroidal load is immersed in a water-filled tank to grade the high electrical stresses. Strip-line connections between the pulser outputs and segments of the toroidal coil are made through diaphragms installed in the abutting faces of the pulser tanks and flexible seals in the load vessel. 100 kJ, LC generators in each of the 11-immersed pulser modules produce a peak circuit voltage of 580 kV. Complete voltage extraction occurs in a time of 14 microseconds; at this time, parallel output switches connect each erected LC generator to a toroid segment via parallel plate strip lines and an interface diaphragm. A total peak current of 3 MA with dI/dt approximately 6E12 A/sec is delivered to the toroidal load coil from the six pulser modules. At current peak, parallel crowbar switches are closed in each pulser to produce an π -fold load current decay time of about 20 microseconds. Synchronous command triggering of both start and crowbar switches is achieved by three master trigger generators, each delivering six high level trigger pulses. 3 Refs.

Primary Keywords: LC Inversion Pulse Generator Module; Triggering Considerations; Series Switching

Secondary Keywords: Shock-heated Torus

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4687
(POWER CONDITIONING)
(Pulse Forming Networks)

L. Masten and T.R. Burkes
Texas Tech University, Lubbock, TX 79409

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIIB-3 (11/1976).

This paper describes a procedure for designing current fed networks to produce constant current pulses into time varying loads. The procedure is an extension of Guillemin's method for PFN design for constant loads. Examples of the procedure and computer derived responses are given. Problems associated with the design of voltage fed networks which produce constant-current pulses into time varying loads are discussed. The primary problem is one of prescribing the appropriate initial conditions for analysis, so that a realizable network may be derived to produce the desired pulse with only an initial voltage on the energy storage capacitor. 0 Refs.

Primary Keywords: Pulse Forming Network; Constant Current; Guillemin's Method; Analysis; Synthesis

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4688
(PULSE GENERATORS)
(Systems)

DISCHARGE CIRCUITRY FOR HIGH REPETITION RATE METAL VAPOR LASERS

L.W. Springer, T.W. Kerres, R.S. Anderson and B.C. Bricks
General Electric Co, King of Prussia, PA

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-1 (11/1976).

The evolution of discharge circuitry for high repetition rate metal vapor lasers is described. The circuitry needed for operation of a $\lambda = 339$ nm discharge-heated copper vapor laser at up to 12 watts average power at 6 kHz rates is given. Switch characteristics and component values are also discussed. 5 Refs.

Primary Keywords: Prepared; Solid-state Trigger; Thyratron

Secondary Keywords: Copper Vapor Laser Pumping

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4689
(SWITCHES, CLOSING)
(Gas Gaps, E-beam)

ELECTRON BEAM CONTROLLED SWITCHING

R.O. Hunter
Maxwell Labs Inc, San Diego, CA 92123

1976 IEEE Pulsed Power Conference Proceedings, Paper IC-8 (11/1976).
Fast switching techniques have been demonstrated which relies on the control of the impedance level of a gas discharge by an electron beam. Unconventional di/dt's in excess of 1E11 Amperes/second were obtained for a 50 kV blocking voltage switch with a forward drop of approximately 1 kV utilizing atmospheric pressure gas in a 10 liter volume as the working medium. The scaling of recombination and attachment controlled switches is discussed in terms of molecular and discharge parameters. It is shown that gases with high drift velocities at low electrical fields are desirable for high efficiency in the switching process. Such switches appear to be scalable to the megampere level and perhaps to recovery times on the order of 1E-8 seconds. 9 Refs.

Primary Keywords: E-beam Controlled Switch; Fast Turn-on; Fast Recovery; Design Considerations; Performance Test

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4690
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps; Electrical; Review)

GASEOUS SWITCHES: THE PAST AND PRESENT STATE OF THE ART

H. Manowitz
English Electric Valve Co Ltd, Chelmsford, Essex, UK

1976 IEEE Pulsed Power Conference Proceedings, Paper IA-2 (11/1976).
Triggered discharge devices which use a gaseous medium to carry the current are discussed in a general manner. Devices operating at pressures above and below atmospheric and in vapours as well as true gases are considered. Normal and quenched spark gaps are described, along with mercury pool and hot cathode devices. A number of cold cathode switches are also briefly mentioned, including flashlamps and trigger tubes. Most emphasis is given to hydrogen thyratrons and ignitrons as these are felt to be of the greatest value in pulsed power generation. Crowbars are discussed as well as modulator applications. In each case the uses of the various devices are indicated along with the advantages and shortcomings where relevant. 0 Refs.

Primary Keywords: Gas Gap; State-of-the-art; Quenched Spark Gap;

Secondary Keywords: Modulator; Applications

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4691
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

INERTIAL ENERGY STORAGE RESEARCH AT THE UNIVERSITY OF TEXAS AT AUSTIN
F. M. Tolks, M.D. Drury, L.B. Barker, M.F. Holden, W.L. Bird, H.G.
Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712

1976 IEEE Pulsed Power Conference Proceedings, Paper IIR-4 (11/1976).

During the past few years, the Energy Storage Group at the University of Texas has been doing research on the design, theory, and application of homopolar machines. Two machines have been built and a third machine is now under construction. This third machine is intended to study the fundamental limitations in fast discharging homopolar machines. Studies have been conducted on other homopolar systems with energy storage of up to 61 MJ. Experimental research areas discussed include brush testing, electromagnetic bearings, and bearing theoretical areas include noise, compression and magnetic field trapping. Other applications of homopolar machines including rotating electrical utility generators, also have been investigated and are discussed. Funding for this program has been provided by the Texas Atomic Energy Research Foundation, the Energy Research and Development Administration and the Electric Power Research Institute 12 Refs.

Primary Keywords: Inertial Energy Storage; Review; Very High Energy; Component Testing; Application

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4692
(PULSE GENERATORS)
(Line Type)

INVERSE VOLTAGE CONTROL IN LINE TYPE PULSE GENERATING CIRCUITS
G. Scales and B.P. Newton
English Electric Valve Co. Ltd., Chelmsford, Essex, UK

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-7 (11/1976).

Line type modulators are used for fast load and inverse voltage removal or protection against cumulative voltage build up following a load failure. The advantages and disadvantages of each are discussed briefly. In addition, two new circuits are described. The first concerns a rapid removal of inverse voltage with precise determination of the voltage zero immediately prior to the recharging of the grid. Although requiring extra components, this new arrangement offers advantages over circuits hitherto employed. The second new circuit is a diode switched charge sharing capacitor circuit designed to remove or reduce the amplitude the short duration inverse spikes which can occur in line type modulators. Should a thyatron be employed as the switching means, this inverse spike can lead to undesirable heating of the grid due to plasma clean up. The circuit described largely eliminates this heating and the two circuits are complementary and may be used together. 6 Refs.

Primary Keywords: Inverse Voltage; Load Failure; Voltage Zero
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4693
(REVIEWS AND CONFERENCES)
(Reviews)

LIGHTWEIGHT MULTIMEGAWATT POWER TECHNOLOGY A SURVEY

R.L. Verma (1), J.P. Heckl (2) and E.J. Amstutz (3)

(1) USAF Aero Propulsion Lab

(2) Naval Surface Weapons Center

(3) US Army Mobility Equipment Research and Development Command

1976 IEEE Pulsed Power Conference Proceedings, Paper IIR-5 (11/1976).

A discussion is presented of the various power system and conditioning technologies available for lightweight multimegawatt applications. Tradeoffs are shown on the basis of critical operating parameters among various power system components. Included are the applicable power sources, turbines (chemically fueled and airbreathing), flywheels, rotating generators (conventional and superconducting), electromechanical devices (batteries and fuel cells) and magnetohydrodynamic generators. Also discussed is the appropriate power conditioning, energy storage (capacitive, inductive), switching (closing, opening) and power conversion (transformers, inverters). An assessment of the current state-of-the-art in each of these technologies is given. Anticipated advancements are discussed and projections are given of potential lightweight low volume electrical power generation and conditioning capabilities through the 1990-20 time period. 9 Refs.

Primary Keywords: High Power Technology; Operating Parameters;

Turbine; Flywheel; Magnetohydrodynamic

Secondary Keywords: Abstract; Survey

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4694
(POWER CONDITIONING)
(Current Limiters)

LIQUID NITROGEN COOLED WIRES AS SWITCHABLE HIGH POWER DIRECT CURRENT LIMITING ELEMENTS

A. S. Colvin and J. D. Marshall

State University of New York at Buffalo, Buffalo, NY 14226

1976 IEEE Pulsed Power Conference Proceedings, Paper IC-5 (11/1976).

While designing a high power current limiting device which utilizes the large change of resistivity with temperature of certain metals, it was discovered that some metals, when immersed in liquid nitrogen may form a jacket of gaseous nitrogen around them and can be heated electrically to any temperature up to their melting point without oxidation. Due to this effect, herein called the vapor lock effect, the resistivity of the metal has been observed to increase by a factor of 20 and power dissipation of up to 500 watts/cm² has been attained. Using these properties along with a six exponential switching arrangement, for several metal elements may aid in the development of reliable and compact high power current limiting devices. 1 Refs.

Primary Keywords: Current Limiters; Resistive Resistor; Liquid Nitrogen; Insulator; Vapor Lock Effect
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4695
(PARTICLE BEAMS, ELECTRON)
(Electrons)

METAL FOILS FOR USE IN PULSED LASER APPLICATIONS

C.O. Hoffman

Los Alamos National Labs, Los Alamos, NM 87545

1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-2 (11/1976). Testing of foils used for electron gun cathodes for laser pumping is presented in this paper. Several foils of different composition are tested and results are presented concerning the number and size of nucleons, grain size, and second and third phases. The effects of freezing are considered, as are the effects of electron acceleration. 8 Refs.

Primary Keywords: Metal Foil; Radiosis; Electron Windows; Specifications; Test Results
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4696
(PARTICLE BEAMS, ELECTRON)

(Generation)

MICROWAVE EMISSION FROM MAGNETICALLY INSULATED RELATIVISTIC ELECTRON BEAM DIODES

G. Bekoff and T.J. Orzechowski

Massachusetts Institute of Technology, Cambridge, MA 02139

Experiments will be described concerning the behavior of cylindrical field emission diodes immersed in externally applied magnetic fields > 20 kG. Switchable current flows are observed even in forbidden regions of magnetic field in which the diode is presumably insulated magnetically. This current flow is accompanied by intense microwave radiation. In the case of smooth anodes, the emission is fairly broadband in frequency, and does not exceed several kilowatts in power. When the anode supports a periodic structure, narrow band emission in the microwave range of powers is observed. In the latter case, approximately 1% of the beam kinetic energy is converted into radiation > 200 W.

Primary Keywords: Microwave Emission; Field Emission Diode; Magnetic Insulation; Smooth Anode; Periodic Structure
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4697
(POWER CONDITIONING)

(Pulse Forming Networks)

NETWORKS FOR DRIVING TEA LASERS

A. Bushnell

Texas Tech University, Lubbock, TX 79409

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIN-4 (11/1976). A new type of pulse forming network is described. The PPN produces a train of pulses for simultaneously driving a CO₂ sub-TEA laser and sustaining the discharge in the TEA laser without arc formation. The PPN offers the advantage of not requiring active circuits such as hard tube modulators. 3 Refs.

Primary Keywords: Pulse Forming Network; Burst Mode; Pulse Train; Pulse Shaping
Secondary Keywords: Gas Laser; Pumping
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4698
(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

ONE MILLISECOND DISCHARGE TIME HOMOPOLAR MACHINE

J.R. Gully, M.D. Drury, R. Grant, H.G. Rylander, F.M. Tolks, M.F.

Holden and H.H. Woodson

University of Texas at Austin, Austin, TX 78712

1976 IEEE Pulsed Power Conference Proceedings, Paper IIR-2 (11/1976). All information one available concerning fast discharge homopolar machines is only theoretical. No such machine has ever been built and existing electrical machines do not approach the extremely severe conditions required for a fast discharge machine. The Energy Storage Group at the University of Texas has now designed and is in an advanced stage of building a very fast discharge experimental homopolar machine which will explore fundamental mechanical and electromagnetic limitations to discharge times. The FDY is a fully compensated, pulsed field homopolar generator with two counterrotating rotors. It will discharge in 1.05 milliseconds when short circuited. The applied field averages 4 Tesla and the equivalent cross section is 35 A-m². When discharged from full speed into a load having 0.275 millihenry inductance and 60 microohm resistance, the discharge time will increase to 3.05 milliseconds and the efficiency of the discharge will approach 80 percent. This research has been funded by the Electric Power Research Institute, Texas Atomic Energy Research and the US Energy Research and Development Administration. 7 Refs.

Primary Keywords: homopolar generator; fast discharge; pulsed field; high voltage; power

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4699
(POWER CONDITIONING)

(Pulse Forming Networks)

PULSE DESIGN INTERFACE WITH E BEAM SUSTAINED GAS DISCHARGE

J.P. Ottolenghi

AEPL, Kirtland AFB, NM 87117

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-5 (11/1976). The one-dimensional time varying conductivity characteristics of electron beam sustained gas discharge require special consideration in the pulse design interface with the pulse forming network and the type of calculations and tables are used to analyze effects of various E-beam parameters on the discharge. And the interface with the PFI. Experimental data is compared to calculations and found to be in reasonable agreement. 2 Refs.

Primary Keywords: E-beam; Discharge; Time Varying Impedance; Pulse Type Modulator; Computer Calculations
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4700
(OPTICAL STUDIES)

(Oscars, Opticals)

DEVELOPMENT AND PERFORMANCE CHARACTERISTICS OF A UV PREIONIZED, HIGH POWER TEA PULSED CO₂ LASER

C. Ohshima and T. Sekiguchi

University of Tokyo, Bunkyo, Bunkyo, Tokyo

Japanese Journal of Applied Physics, Vol. 15, No. 8, pp. 1593-1596 (1976).

A high power TEA CO₂ laser has developed and tested. The laser used UV preionization and produced a total output energy of 300 mJoules with the first pulse lasting 50 ns. The preionization characteristics, the effect of the preionization on the main discharge, the effect of gas composition on the small signal gain and loss of electron characteristics are also discussed. 12 Refs.

Primary Keywords: UV Preionizer; Energy Deposition; Discharge Characterization

Secondary Keywords: Gas Laser; Pumping

COPYRIGHT: 1976 IEEE. PULSED LASER BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

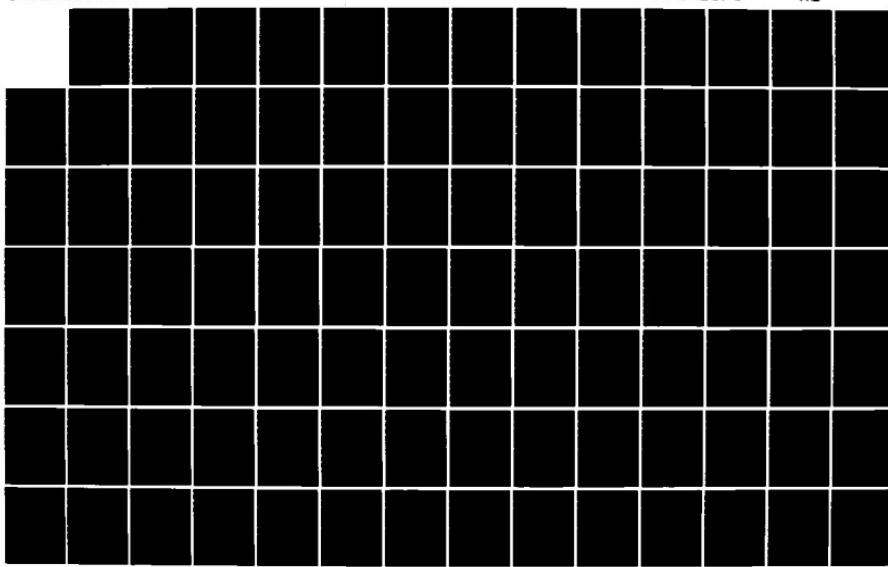
AD-A131 753 PULSED POWER BIBLIOGRAPHY VOLUME 2 ANNOTATED
BIBLIOGRAPHY(U) AIR FORCE WEAPONS LAB KIRTLAND AFB NM
J BEMESDERFER ET AL. AUG 83 AFWL-TR-83-74-VOL-2

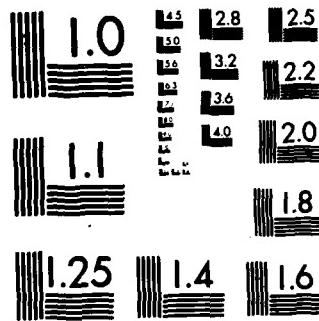
2/3

UNCLASSIFIED

F/G 20/5

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

4781
(ENERGY STORAGE, CAPACITIVE)
(Systems)

PRINCIPAL CONSIDERATIONS IN LARGE ENERGY-STORAGE CAPACITOR BANKS
E.L. Jensen
Los Alamos National Labs, Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC-1 (11/1976).
Capacitor banks storing one or more megajoules and costing more than one million dollars have unique problems not often found in smaller systems. Two large banks, Scyllac at Los Alamos and Shiva at Livermore, are used as models of large, complex systems. Scyllac is a 10-MJ, 60-kV theta pinch system while Shiva is a 20-MJ, 20-kV energy system for laser flash lamps. A number of design principles are emphasized for expediting the design and construction of large banks. The sensitive features of the charge system, the storage system layout, the switching system, the transmission system, and the design of the principal bank components are presented. Project management and planning must involve a PERT chart with certain common features for all the activities. The importance of the budget is emphasized. 3 Refs.

Primary Keywords: High Energy Capacitor Bank; Scyllac Bank; Shiva Bank; Design Considerations; Construction Schedule

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4782
(ENERGY STORAGE, CAPACITIVE; PARTICLE BEAMS; ELECTRON; SYSTEMS)
(Marx Generators; Generation)

PULSED POWER SYSTEMS FOR THE LASL HIGH ENERGY GAS LASER FACILITY
K. Rasmussen and Janssen
Los Alamos Nat'l. Lab., Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIC5-1 (11/1976).
The laser division at Los Alamos Scientific Laboratory is designing a CO₂/sub 2/ laser fusion experiment with the goal of delivering 100 kJ to the target in a one nanosecond pulse. The laser will be pumped by an electron-beam-controlled discharge. The pumping power supply will be a number of parallel Marx generators, with an output voltage of 500 kV, and a total energy storage of about 5 MJ. The electron gun is a cold cathode triode, also operating at about 500 kV. Preliminary design considerations for the pulsed power systems are presented. Some pulse forming network designs are discussed with calculated waveforms shown. 1 Refs.

Primary Keywords: Marx Generator; Cold Cathode Triode; Reliability

Secondary Keywords: Gas Laser; Pumping

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4784
(SYSTEMS)
()

PULSE POWER REQUIREMENTS FOR LASER ISOTOPE SEPARATION SYSTEMS
P. Mace, E.A. O'Hair and M. Pillich

Los Alamos National Lab., Los Alamos, NM 87545

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-3 (11/1976).
The uranium enrichment process currently under investigation at the Los Alamos Scientific Laboratory will require pulsed lasers with unique characteristics. The requirements are such that great demands will be made on the state-of-the-art in terms of pulsed power components and techniques. This paper is devoted to a discussion of the pulsed laser output characteristics and their relationship to available electrical devices. Further research areas will be designated as they are seen to affect the system requirements. 8 Refs.

Primary Keywords: Laser Isotope Separation; Rep-rated; Switching Requirements

Secondary Keywords: IR Laser; UV Laser

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4786
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)

RECENT DEVELOPMENTS IN HIGH POWER SWITCH TUBES FOR HIGH POWER RADAR AND FUSION RESEARCH
Mark. J. T. and J.A. Eshleman

RCA Corp., Lancaster, PA 19604

1976 IEEE Pulsed Power Conference Proceedings, Paper IC-5 (11/1976).
This paper describes two tubes now in development. The first is a 425 kW, 20 kV switch tube with a long life, tungsten matrix cathode and conduction cooled, copper alloy grids. The second is a 24 megawatt, 200 kV switch tube with thoriated tungsten cathodes and water cooled electrodes. 1 Refs.

Primary Keywords: RCA A2960B Switch Tube; Tungsten Matrix Cathode; Copper Alloy Grid; Thoriated Tungsten Cathode; Long Life

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4787
(SWITCHES, CLOSING)
(Thyristors)

SOLID STATE HIGH POWER PULSE SWITCHING

P.F. Pittman and D.J. Page

Westinghouse Electric Corp., Pittsburgh PA

1976 IEEE Pulsed Power Conference Proceedings, Paper IA-3 (11/1976).

In this paper, the structural features and the methods of turning on high power thyristors, reverse blocking diode thyristors and light activated silicon switches are reviewed. The advantages and limitations of these devices are described together with a description of the performance achieved to date by the various devices. Finally, the operation of these devices in series strings to form high power switching modules is described. 2 Refs.

Primary Keywords: High Power Thyristor; Reverse Blocking Diode; Thyristor; Light Activated Silicon Switch; Performance; Series Strings

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION.

4788
(SWITCHES, CLOSING)
(Liquid Metal)

THE LIQUID METAL PLASMA VALVE CLOSING SWITCH

J.R. Bayless (1) and J.P. Heckl (2)

(1) Hughes Research Labs, Malibu, CA 90265

(2) Naval Surface Weapons Center, Silver Spring, MD 20910

1976 IEEE Pulsed Power Conference Proceedings, Paper IB-3 (11/1976).

The liquid metal plasma valve is a high average power mercury vacuum-arc switching device. It has been extensively developed over the past ten years as a converter valve for the use by the electric utility industry at nominal average power levels of 90 MW. This paper will describe an LMP closing switch now under development for operation in conjunction with an FPP to deliver 100 MW average power to a load in 20 to 50 microsecond pulses at up to 100 kV. The objective of this development is to obtain information for the design of switches capable of operating at much higher power levels. 1 Refs.

Primary Keywords: Liquid Metal Plasma Valve; High Average Power;

Vacuum Arc; Ignitor

Secondary Keywords: Pulse Forming Network

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4789
(SWITCHES, OPENING)

(Vacuum Gaps; Plasma Erosion)

THE PLASMA EROSION SWITCH

C.W. Mendel, A.A. Goldstein and P.A. Miller

Sandia Labs, Albuquerque, NM 87115

1976 IEEE Pulsed Power Conference Proceedings, Paper IC-2 (11/1976).

The plasma erosion switch is a device capable of initially carrying high currents, and then of opening in nanoseconds to stand off high voltages. It depends upon the erosion of a plasma which initially fills the switch. The sheath between the plasma and the cathode behaves as a diode with a rapidly increasing A-K gap. Preliminary tests of the switch on the Proto I accelerator at Sandia will be described. In these tests, the switch consisted of a cylinder of highly ionized plasma four inches in diameter and one-inch thick surrounding a one-inch cathode. The switch shorted out a prepulse voltage and allowed energy to be stored in the diode inductance outside the switch until the accelerated current reached 75 kA. The switch impedance then rose rapidly to approximately 100 ohms in 5 nanoseconds, whereupon the accelerator current transferred to the cathode. Current rise rates of 3E13 A/sec were limited by cathode turn-on. Voltage rise rates of 1E15 V/sec were achieved. The elimination of prepulse and machine turn-on transients allowed A-K gaps of 2 mm to be used with 2.5 MV pulses, yielding average E fields of 12 MV/cm. 0 Refs.

Primary Keywords: Plasma Erosion Switch; Diode; Fast Opening Time;

Plasma Deposition

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4790
(SWITCHES, OPENING)

(Vacuum Gaps; Magnetic Field)

THE PRESENT STATUS AND PROJECTED CAPABILITIES OF VACUUM ARC OPENING SWITCHES

A.S. Gilmour

State University of New York at Buffalo, Buffalo, NY 14226

1976 IEEE Pulsed Power Conference Proceedings, Paper IC-1 (11/1976).

Vacuum arc opening switches are under development at the State University of New York at Buffalo. The configuration of these devices is such that electron current is forced to flow, primarily, radially outward from the end of a relatively small rod shaped cathode to a ring shaped anode. The source of current is a vacuum arc that is initiated on the surface of the cathode by a pulse to an igniter, also on the cathode. Current generation is limited by the distance from the cathode to anode region resulting in low switch drop during conduction. Current control is achieved through the application of an axial magnetic field. Operating characteristics that have been achieved are circuit interruption at DC voltages up to 25 kV, control of currents up to 10 kA and operation at repetition frequencies up to 1 kHz. The turn-on and turn-off times are, respectively, as short as one and two microseconds. The pulse width is continuously variable. Applications being considered at the present time include high-power inverters, fault-current limiters and high-power modulators. The status of the device development is described and then projected capabilities are given. 10 Refs.

Primary Keywords: Vacuum Arc Opening Switch; Low Dissipation; Magnetic Field Interruption Mechanism

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4791
(ENERGY CONVERSION, ELECTRICAL)

(Charging Circuits)

TIME SELECTIVE RECHARGING OF AN AUXILIARY PULSER

E.H. Hooper and R.A. Gardenghi

Westinghouse Electric Corp., Baltimore, MD 21203

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIB-7 (11/1976).

This paper describes a technique for maximizing the utilization of a prime power source when the principle load is a line type pulser. A reasonably charged line-type pulser draws energy from the prime source in a periodic manner resulting in dead spots or load valleys between cycles. Time limited resonant charging may be used to draw energy from the prime source during these load valleys to provide power for auxiliary equipment. This increases power available from the source without increasing peak power demand. Basic circuits and waveforms are presented. 2 Refs.

Primary Keywords: Charging Circuit; Line Type Pulser; Maximum Utilization of Power

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4792
(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

U.S. AIR FORCE SUPERCONDUCTING GENERATOR DEVELOPMENT

H.L. Southall

AFAPL, Wright-Patterson AFB, OH

1976 IEEE Pulsed Power Conference Proceedings, Paper IIB-8 (11/1976).

A review of Air Force sponsored development of 12,000 rpm superconducting generators is presented. Results are given for recent critical component tests including stator coils and four coil rotor assembly. A brief discussion of potential future work in high power superconducting generators is given. Superconducting generators with specific weights of less than 0.1 lb/kva in the multimegawatt class can be anticipated. 7 Refs.

Primary Keywords: Superconducting Generator; Lightweight Generator;

Airborne Power Supply

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

4713
(POWER CONDITIONING)
(Pulse Transformers)
ANALYSIS OF POWER TRANSFORMERS UNDER TRANSIENT CONDITIONS
D.L. Lockwood, R.I. McNall Jr. and R.F. Whitbeck
Thermal Technology Lab., Inc., Buffalo, NY
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-1 (11/1976).
Low specific weight transformers may be designed to operate under impulse conditions well above the steady state limit. This usually results in nonlinear current and voltage transformation. A procedure is outlined in this paper for the analysis of lumped parameter transformer models with nonlinear self-inductance. An algorithm for modeling inductance is developed which is accurate for square loop cores as well as ordinary soft magnetic materials. A simple routine which can be implemented with modest computing power is used to determine the dynamic response of transformers driven by a variety of sources. The model permits independent assignment of initial conditions for the magnetic state of the core and the phase of the driving source. This permits a computation of inrush currents and output waveforms under the entire range of possible initial conditions. This work was sponsored by the United States Air Force Aero Propulsion Laboratory, Wright Patterson Air Force Base, Ohio. 2 Refs.

Primary Keywords: Lightweight Power Transformer; Pulse Application; Modelling

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4714
(PULSE GENERATORS)
(Trigger)
AN AIR-POWERED FIBER-OPTIC COUPLED PULSER SYSTEM FOR CTR EXPERIMENTS
M.C. Lohr and A.J. Brozyna
Los Alamos National Lab., Los Alamos, NM 87545
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-6 (11/1976).
The design, construction, and operation of an air-powered fiber-optic coupled pulser system for initiating various high-voltage systems in Controlled Thermonuclear Research Experiments are discussed. The pulser system provides complete electrical isolation of the experimental high-voltage circuits from the timing and control circuits. It also prevents crosstalk between individual pulser output channels and eliminates trigger system ground loops. The electronic design and reliability of the pulser system, including the fiber-optic electrical interface considerations, are discussed. A description of the air-driven power supply and a brief cost analysis of this system compared to conventional pulser systems are presented. 8 Refs.

Primary Keywords: Pulser; Fiber Optic Coupling; Electrical Isolation; Air-driven Power Supply

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4715
(POWER CONDITIONING)
(Pulse Transformers)
AN ANALYSIS OF CO-AXIAL PULSE TRANSFORMERS
R. Dollinger and D.L. Smith
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-4 (11/1976).
The basic idea of using coaxial cable as an isolation pulse transformer for triggering spark gaps is not new. However, there are several distinct advantages of driving the braid as the primary as opposed to driving the inner conductor. The fundamental advantage is that the ratio of the output voltage to the input voltage is unaffected by the thickness of insulation between the inner conductor(s) and the braid. Thus, the transformer with the braid as the primary works well for isolating high secondary to primary voltages. This and other advantages are demonstrated. 6 Refs.

Primary Keywords: Co-axial Pulse Transformer; Outer Conductor Primary; Strong Coupling; High Voltage

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4716
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A INEXPENSIVE HIGH VOLTAGE PROBE
R. Dollinger and D.L. Smith
Texas Tech University, Lubbock, TX 79409
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-8 (11/1976).
A simple, easily constructed, high voltage probe (<= 300 kV) with a good frequency response (<= 100 MHz) and high input impedance (>= 10 kohm) is desirable in many applications. Such a probe, constructed by the two concentric type, is described and reported. 2 Refs.

Primary Keywords: High Voltage Probe; Simple Design; Simple Construction; High Frequency Response

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4717
(ENERGY CONVERSION, THERMAL)
(Loads)
A COMPACT LOW INDUCTANCE LOAD FOR PULSE TESTS
R.D. Gourley
Hughes Aircraft Co., Culver City, CA 90230
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-6 (11/1976).
The development of a low inductance resistive load for high energy pulse tests is described. The performance requirements and design alternatives for a specific application are discussed. The selected design is an air cooled bank of silicon carbide resistors in parallel coaxial mounts. This design has an inductance less than 25nH, a continuous power dissipation exceeding 50kW and a peak pulse voltage rating of 22kV. The load will operate 40kV off ground. The grounded enclosure is a 3-foot cube that permits stacking for higher power requirements. 3 Refs.

Primary Keywords: Resistive Load; Low Inductance; High Power; Medium Voltage

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4718
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)
(Systems; Systems)
A HIGH CURRENT, HIGH FREQUENCY CAPACITIVE ENERGY STORAGE SYSTEM USED TO PRODUCE INTENSE MAGNETIC FIELDS
D. Markins, J. Bandas and M.T. Olson
Maxwell Labs Inc., San Diego, CA 92125
1976 IEEE Pulsed Power Conference Proceedings, Paper IIIID-2 (11/1976).
Recent component design and fabrication concepts have evolved a versatile high current, low inductance capacitive energy storage system in which modular approach allows for expansion to larger systems. The design utilizes low inductance, high voltage, reverse capacitors with a low profile bushing. The capacitors are connected in parallel in a mylar insulated parallel plate transmission line. An important feature of the design is the gas, multichannel, rail spark gap switching system which provides low inductance combined with high current, high Coulomb capabilities. A system incorporating these design features is currently in operation to produce intense pulsed magnetic fields. The machine is a 50 kV, 60 kJ, 9 nH design which is capable of currents in excess of 1 MA and dI/dt's of 5E12 amp/sec. In the present application, the load is a single turn inductor and the peak current is 1.2 MA. Pulsed magnetic fields of 300,000 Gauss have been produced at frequencies of 100 kHz. Fields of these frequencies and intensities are being used to impact-bond metals, illustrating the many potential applications of such a system. 1 Refs.

Primary Keywords: Capacitor Bank; High Current; Low Impedance; Rail Gap; Pulsed Magnetic Field

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4719
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Systems; Systems)
A MODULAR POWER-CROWBAR BANK FOR THE GENERATION OF A 50 MA, 50 MICROSECOND CURRENT PULSE FOR THE TOROIDAL PLASMA EXPERIMENT HBS II AT GARCHING
E. Breit, J.E. Gruber, M. Munich, G. Schramm, U. Seidel and R. Sub Max-Planck-Institut für Plasmaphysik, Garching, Euratom Assoc.
1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-7 (11/1976).
The 50 m long, ring-shaped stellarator coil for the toroidal HBS II experiment at Garching will be fed from a low inductive modular power-crowbar bank. A start bank 2 x 40 kV, 768 kJ consisting of 96 modules generates a submicrosecond current rise, while the power-crowbar bank 3 kV, 3.3 MJ extends the pulse for 50 microseconds. The slide-in modules with newly developed capacitors and double-gap switches are described as well as the channel diagnostics by means of fibra-optics. 1 Refs.

Primary Keywords: Capacitor Bank; High Energy; Low Voltage; Low Inductance; Modular Construction; Double-gap Spark Gap

Secondary Keywords: Stellarator

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4721
(ENERGY STORAGE, INDUCTIVE)
(Reviews)
DEVELOPMENT OF INDUCTIVE STORAGE FOR GENERATION OF HIGH VOLTAGE PULSES
I.M. Vitkovitsky
Naval Research Lab., Washington, DC 20375
1976 IEEE Pulsed Power Conference Proceedings, Paper IID-2 (11/1976).
Traditionally, the generation of very high power electromagnetic pulses has applied to the production of intense relativistic beams, dense hot plasmas and other transient phenomena. This demand on the capacitive energy storage. Growing needs for increased energy capability of the generators has led to studies and proposals to demonstrate the feasibility of using magnetic storage systems with high voltage, power-multiplying stages as a means of satisfying these needs. Most recent progress in the development of the elements for such high power systems is presented. Examples demonstrating the integration of inductive storage and high voltage technologies, to achieve high power output are considered. 12 Refs.

Primary Keywords: Inductive Energy Storage; Basic Concepts; Circuit Breaker; Explosive Interrupter

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4722
(PULSE GENERATORS)
(Systems)
HIGH-VOLTAGE PULSE GENERATORS OF THE BASE OF THE SHOCK TRANSFORMER
E.A. Abramyan
Academy of Sciences of the USSR, Moscow, USSR
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-3 (11/1976).
A review of the accelerators comprising a resonance transformer with shock excitation as a power supply source is given. Operating voltage is approximately 1 MV, pulse length 1E-7 - 1E5 sec, repetition rate - up to 100 Hz and above. 12 Refs.

Primary Keywords: Pulse Generator; Shock Transformer; Rep-rated

Secondary Keywords: E-beam Generation

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4723
(SWITCHES, CLOSING)
(Vacuum Gaps, RF)
CONTROLLED DISCHARGE IN A VACUUM GAP SWITCHED BY 1 MC CURRENT PULSES OF UP TO 150 KA
P.N. Dashuk, G.S. Kichaeva and M.D. Yarysheva
Soviet Physics Journal, Vol. 11, No. 1, pp 1-7 (01/1968).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 11, 11-16 (1968)
The firing delay time, the rise time of the current up to its maximum, and the primary current amplitude of a controlled discharge in a vacuum gap are considered, for a voltage range 10-80 kV, with a residual gas pressure in the chamber of 1E-4 - 1E-5 mm of mercury. The gap is switched by a damped oscillatory current pulse with a frequency of 1.25 MHz and a maximum amplitude of about 150 kA. The discharge is started by either one or three triggering devices. 5 Refs.

Primary Keywords: 1.25 MHz Current Pulse Frequency; 10-80 kV Voltage Range; Damped Oscillatory Current Pulse; 150 kA Maximum Amplitude; Controlled Discharges

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

6724
(PARTICLE BEAMS, ELECTRON)
(Generation)

LILI, A 0.5-1.5 MICROSECOND, 600 KV ELECTRON BEAM ACCELERATOR
R.S. Clark and K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-1 (11/1976).
A 600 kV, 5-14 kJ, 0.5-1.5 microsecond electron beam accelerator has been developed for gas laser excitation studies. The 1.2 MV Marx generator charges a 2 nF, solid dielectric peaking capacitor to 2.3 MV in 0.6 microsecond. The pulse duration is controlled by a crabmer switch. Anode geometries were varied to generate a uniform current density beam and minimize the beam energy density that could be passed through thin foils. A 7.6 cm diameter cylindrical beam is guided through the laser chamber by a 1-3 kG axial magnetic field. The design and development of the accelerator, including experimental results of diode studies, are discussed. 15 Refs.
Primary Keywords: E-beam; Field Emission Vacuum Diode; Marx Generator; Low Inductance
Secondary Keywords: Gas Laser
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6725
(PARTICLE BEAMS, ELECTRON; PULSE GENERATORS)
(Generation; Blumlein Lines)

MODULATOR-REPETITIVELY PULSED FIELD EMISSION ELECTRON BEAM GUN INTERFACE
G.J. Dezenberg (1), M. Wright (2) and S. Schnieder (2)
(1) Army Missile Command, Redstone Arsenal, AL 35809
(2) ECOM, Fort Monmouth, NJ 07703
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-2 (11/1976).
A field emission electron beam gun is repetitively pulsed with a modulator in a Blumlein arrangement. The modulator is operated in an unmatched condition with the output connected directly to the gun. The gun is a time varying monotonically decreasing impedance load while the modulator impedance is constant. The modulator-gun configuration produces an initial voltage peak which approaches twice the cathode voltage to promote gun emission. After the initial peak, the load voltage relaxes at a value determined by the gun impedance. Peak voltages in excess of 35 kV and peak currents up to 8 kA have been delivered in 5 microsecond pulses by the modulator to the gun. The modulator routinely operates at 50 Hz repetition rate, 135 kV recharge voltage and about 3 amps of average current. 5 Refs.
Primary Keywords: E-beam Gun; Repetitive; Blumlein; Cold Cathode; Pulse Forming Network
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6726
(PULSE GENERATORS; REVIEWS AND CONFERENCES)
(Reviews; Reviews)

HANDBOOK PULSE GENERATORS FOR MAGNETRON OPERATION
R.E. Nylander and G.J. Auger
Naval Weapons Center, China Lake, CA 93555

1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-4 (11/1976).
To operate with pulse durations of under 15 ns, most magnetrons require a special type of modulation signal. This paper describes the design and operation of practical short pulse modulator circuits providing magnetron outputs of as short as 7 ns. The resulting transmitters provide an economical approach to high resolution radar systems. The short pulse techniques have also been used to enhance the coherent operation of magnetrons which are being pumped with an RF reference signal. 4 Refs.
Primary Keywords: Short Pulse Generator; Modulator; Pedestal Generator
Secondary Keywords: Magnetron; Radar
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6727
(ENERGY STORAGE, CAPACITIVE)

PULSED ENERGY AND SWITCHING REQUIREMENTS FOR TOKAMAK OHMIC HEATING
H.F. Wogel (1), K.I. Thompson (1), H. Bird (2) and F.M. Heck (3)
(1) Los Alamos National Labs, Los Alamos, NM 87545
(2) University of Texas at Austin, Austin, TX 78712
(3) Westinghouse Electric Corp., Fusion Power Systems Dept.

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIIE-9 (11/1976).
The electrical circuit requirements are presented which result from a study of the ohmic-heating system of a Tokamak Experimental Power Reactor (EPR). A computer model for plasma startup was developed as part of an electrical network analysis program. The results of a parametric study are presented in which the pulsed energy and volt-second-requirements were optimized, electrical machinery was selected, and the switching requirements were defined. 4 Refs.

Primary Keywords: Pulsed Power Requirements; Numerical Calculation; Modeling

Secondary Keywords: Tokamak; Ohmic Heating
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6728
(PARTICLE BEAMS, ELECTRON)
(Systems)

REBLE, A RADIALLY CONVERGING ELECTRON BEAM ACCELERATOR
J.J. Ramirez and K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-3 (11/1976).
The Reble accelerator at Sandia Laboratories is described. This accelerator was developed to provide an experimental source for studying the relevant diode physics, beam propagation, beam energy deposition in a gas using a radially converging e-beam. The nominal parameters for Reble are 1 MV, 200 kA, 20 ns e-beam pulse. The anode and cathode are concentric cylinders with the anode as the inner cylinder. The radial beam can be propagated through the thin foil anode into the laser gas volume. The design and performance of the various components of the accelerator are presented. 11 Refs.
Primary Keywords: Reble; Field Emission; Vacuum Diode; Transport; Energy Deposition
Secondary Keywords: Gas Laser
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6729
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Generation; Transport)

RECTANGULAR BEAM SCALING LAWS
J. Shennan
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper ID-6 (11/1976).
Scaling laws for rectangular electron beams in the time regime 0.1 microseconds are presented. The data covers the parameter ranges 0.5-1 MV, 1-10 cm gap spacing, up to 100 cm lengths and 7.5-30 ohms impedance. The temporal behavior of the impedance relations is also discussed. 9 Refs.
Primary Keywords: E-beam; Rectangular Beam; Child-Langmuir Law; Variable Impedance
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6730
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

CALIBRATION OF A KERR CELL SYSTEM FOR HIGH-VOLTAGE PULSE MEASUREMENTS
E.C. Cassidy (1), H. N. Cones (1), DC Munsch (2) and S.R. Booker (2)
(1) National Bureau of Standards, Washington, DC 20234
(2) Sandia Labs, Albuquerque, NM 87115

IEEE Transactions On Instrumentation And Measurement, Vol. IM-17, No. 4, pp 313-320 (12/1968).

Several techniques for calibration of an electrooptical (Kerr cell) high-voltage pulse measuring system are described. Independent calibrations, without reference to pulse divider measurements, are achieved by application of a direct bias voltage to the kV demonstrator reasonable agreement (to within 1 percent) between simultaneous Kerr cell and calibrated pulse divider measurements. 6 Refs.

Primary Keywords: Kerr Cell; Calibration Technique; Several Calibration Methods; 1 Percent Measurement Accuracy
Secondary Keywords: 1968 IEEE, Reprinted With Permission

6731
(BREAKDOWN STUDIES)

(Liquid, Electrical)
SHORT PULSE ELECTRICAL BREAKDOWN STRENGTH OF H/SUB 2/O

J.P. Vandendriessche
Sandia Labs, Albuquerque, NM 87115

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIE-3 (11/1976).
The electrical breakdown strength $E_{sub Bd}$ of a water dielectric transmission line has been measured for $7E-9 \leq t \leq 3E-8$ sec, 455 volts $\leq V \leq 1.1E$ volts, and $6E7 V/m \leq E_{sub Bd} \leq 1.1E8 V/m$. The stressed area was approximately 0.1 m^2 , and a Weibull analysis was used to determine the area scaling. Values of $E_{sub Bd}$ obtained were as much as 80 percent higher than that given by extrapolation of the long pulse formulas to $t = 2E-8$ sec. 3 Refs.

Primary Keywords: Breakdown Strength; Medium Area; Short Pulse

Comparison To Long Pulse
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6732
(PARTICLE BEAMS, ELECTRON)

(Generation)
SPACE-CHARGE FLOW IN A NON-CYLINDRICALLY SYMMETRIC DIODE

J.P. Quintenz and J.W. Poukey
Sandia Labs, Albuquerque, NM 87115

1976 IEEE Pulsed Power Conference Proceedings, Paper IE-4 (11/1976).
The one-dimensional cylindrical space-charge-limited emission and flow results are Langmuir and Biedgett are extended to the two-dimensional (r -theta) non-symmetric case by solving a fluid model numerically. It is found that particle beams thus generated can be controlled by suitable adjustment of the applied potentials and cylinder radii. A particle code has been modified for the razor blade cathodes by including a simplified model for the blade emission. Numerical results are compared with experimental data. These results indicate that beams produced by razor blades pinch less tightly than those from block cathodes, but in some cases may still pinch enough to be interesting. 17 Refs.

Primary Keywords: E-beam; Space Charge; Numerical Calculation; 2-d Fluid Model; Optimization

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6733
(PULSE GENERATORS)

(Miscellaneous)

THE BOUNCING CONDUCTOR GENERATOR

E. Kunhardt, J. Tardiff and E. Cheo
Polytechnic Institute of New York, Farmington, NY 11735

1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-7 (11/1976).
A generator has been built which uses a conducting body to trap charge between two electrodes. The generator is known as the BCG, produces baseband pulses with peak voltages of 7 kilovolts and approximately 5 nsec. rise time at a repetition rate of 70-100 pulses/sec. The peak power into a 50 ohm line is .58 MW. 2 Refs.

Primary Keywords: Bouncing Conductor Generator; Short Rise Time; Mechanical Charge Transfer

COPYRIGHT: 1976 IEEE REPRINTED WITH PERMISSION

6734
(ENERGY STORAGE, INDUCTIVE)

(Inductors)

THE MEGAauss MAGNETIC FIELD LABORATORY IN GRENOBLE

M. Guillet (1), J. Belancon (2) and R. Storaert (3)

(1) Lab de Magnetisme, Grenoble Cedex, France

(2) Centre d'Etudes de Valjoures, Sevran, France

(3) CEA Centre d'Etudes Nucleaires, Saclay, France 92260

1976 IEEE Pulsed Power Conference Proceedings, Paper IIID-1 (11/1976).

Two process of high transient magnetic field production are analyzed. With the first one, fields up to 130 T are performed by capacitor bank discharge through single turn-coil; the stability of the coil under thermal and mechanical action is discussed. tantalum appears to be the best choice as coil material. The second one is based on magnetic flux compression using explosive driven implosion of a liner. A simple cylindrical liner and its initiation generator are described. Fields up to 300 T (10 MS) are obtained using moderate capacitor bank energy (43 kJ). 11 Refs.

Primary Keywords: Very High Magnetic Fields; Capacitor Discharge; Flux Compression; Liner Implosion

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4735
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

WEIGHT ALGORITHMS FOR ADIABATIC TRANSFORMERS FOR PULSED HIGH POWER SYSTEMS

R.P. McNeill (1), D.L. Lockwood (1) and A.S. Gilmour Jr. (2)

(1) Thermal Technology Lab., Inc.

(2) State University of New York at Buffalo, Buffalo, NY 14226

1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-5 (11/1976).

A transformer design computer program developed by Thermal Technology Laboratory, Inc. has been used in a mode whereby it automatically minimized the weight of a transformer with any given set of operating parameters. Four classes of adiabatic transformers (wherein heat capacity is used to absorb heat generated) for use in pulsed power systems have been investigated in detail. Two of these were at power levels in the 10 to 50 MW range and the other two were in the 1 to 5 MW range. In each power range, three-phase square wave transformers were analyzed in detail. The three-phase transformers would be used in conjunction with the alternators. The single phase units would be used in inverters. This paper gives a brief description of the transformer design program and then summarizes the results of weight studies on over 120 optimized transformers designed for operation at various powers, voltages, frequencies and pulse durations. Algorithms, developed for calculating transformer specific weight as functions of these parameters are given. 1 Refs.

Primary Keywords: Transformer Design; Computer Aided Design; Adiabatic Mode; Light Weight

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4736
(PARTICLE BEAMS, ELECTRON)
(Generation)

100 GW ELECTRON BEAM GENERATOR

H.I. Milde (1) and M.M. Harris (2)

(1) Ion Physics Corp., Burlington, MA 01803

(2) Naval Research Lab., Washington, DC 20375

1976 IEEE Pulsed Power Conference Proceedings, Paper ID-4 (11/1976).

A 100 GW electron beam generator consisting of an LC generator, a coaxial wave line, and a 8-channel output switch, and a field emission diodes are described. This generator, directed toward the support of research activities, is capable of producing up to 6 kJ of beam energy with particle energies in the range of 100 to 500 keV. 8 Refs.

Primary Keywords: E-beam Generator; LC Pulse Generator; Field-Emission Diode; Ion Beam Conversion; Neutrons; High Power

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4737
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)

PULSE DISCHARGE CAPACITOR WEIGHT MINIMIZATION BY PEAK FOIL EDGE FIELDS

R.D. Parker

Hughes Aircraft Co., Culver City, CA 90230

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIIB-2 (11/1976).

Corona failure at foil edges is the principle failure mechanism in well designed and manufactured high energy density pulse discharge capacitors, by forming the foil edge with laser cutting or spark discharge machining, a 25 percent increase in corona inception voltage over untreated edges is obtained. Folded foil produces a larger increase. Weight minimization using peak edge field as the limiting factor suggests a configuration where the foil and dielectric are of equal thickness produces the lightest capacitor. Typical designs are presented. 4 Refs.

Primary Keywords: Pulse Discharge Capacitor; Weight Minimization; Foil Edge Fields; Failure Modes

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

4741
(SWITCHES, CLOSING)
(Mechanical)

A SIMPLE CIRCUIT FOR THE PRODUCTION OF A HIGH VOLTAGE STEP

G. Clarke and A. Roberts

Huddersfield Polytechnic, Huddersfield

Journal of Physics E: Scientific Instruments, Vol. 5, pp 848-849 (09/1972).

This note describes the development of a circuit and switch capable of producing a highly stable step voltage of up to 30 kV, with a switching time of 1 ms. The design allows absorption current measurements to be made which are not possible at low voltages on certain dielectric materials. 2 Refs.

Primary Keywords: High Voltage Power Supply; Mechanical Switch; Magnetically Driven Plunge (solenoid); 1 ms Rise Time; Dashpot; Little Contact Bounce

COPYRIGHT: 1972 INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4743
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

A TRIGGERED SPARK GAP WITH ROTATING ELECTRODES

H.W. Fulbright

University of Rochester, River Campus Station, Rochester, NY 14627

Nuclear Instruments And Methods 104, pp 71-72 (05/1972).

A spark gap used for triggering a spark counter is described. featuring rotating Sparkerite electrodes. It operates for more than 100 firings without apparent deterioration of characteristics. 0 Refs.

Primary Keywords: Electrically Triggered Spark Gap; Rotating Electrodes; High Reliability; Low Brush Wear

COPYRIGHT: 1972 NORTH-HOLLAND PUBLISHING CO, REPRINTED WITH PERMISSION

4744
(SWITCHES, CLOSING; INSULATION, MATERIAL; SYSTEMS)
(Gas Gaps, Electrical; Solid)

A VERSATILE 60 KV SWITCHING SYSTEM FOR PULSED EXCITATION OF LASERS

L.R. Lidholm

Research Institute of National Defense, Stockholm, Sweden

The Review Of Scientific Instruments, Vol. 43, No. 12, pp 1765-1768 (12/1972).

A fast switching high voltage system capable of handling 60 kV is described. The system utilizes a sealed-off pressurized hydrogen gas gap as a switching device. A versatile silicone rubber coupling module makes different high voltage components easily interchangeable without the need of draining off any insulation liquid. The system was used to build a laser, which emits radiation pulses of a few nanoseconds duration at a wavelength ranging from 337 nm in the ultraviolet region of the spectrum to 9.0 microns in the infrared. The uv pulses contain enough energy to permit pumping of a tunable rhodamine 6 G dye laser. 20 Refs.

Primary Keywords: Hydrogen Spark Gap; Atmosphere Pressure; Insulation Technique; Silicone Rubber Boot

Secondary Keywords: Dye Laser Pumping

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4745
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

AN OPTICAL TECHNIQUE FOR HIGH VOLTAGE MEASUREMENTS

Unknown

Optical Spectra, Vol. 6, No. 9, pp 19-20 (09/1972).

A method of measuring pulsed high-voltages using optical fringe patterns is presented. The fringe pattern is produced in a calibrated Kerr cell which is illuminated with an expanded-beam pulsed laser so that high-speed photographic equipment can record the optical fringe. 0 Refs.

Primary Keywords: Kerr Effect; High Isolation; Nitrobenzene; Argon Laser; No Space Charge

COPYRIGHT: 1972 OPTICAL PUBLISHING CO.

4746
(SWITCHES, CLOSING)

(Vacuum Gaps, E-beam)

BREAKDOWN OF A VACUUM SPARK GAP TRIGGERED BY AN ELECTRON BEAM

H.V. Belan, V.F. Gaidukov, G.I. Kostyuk, E.K. Ostrovskii and I.V. Stral'kov

Khar'kov Aeronautical Institute, USSR

Soviet Physics-Technical Physics, Vol. 17, No. 2, pp 383-385 (08/1972).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 382-384 (February 1972).

Breakdown of a vacuum spark gap by an electron beam is studied. The breakdown criterion is related to the critical pressure of metal vapor in the evaporation zone at which an experimentally observable avalanche buildup of current takes place. The dependence of the discharge time lag on the electron beam parameters is examined. 4 Refs.

Primary Keywords: Metal Evaporation; Evaporation Zone; Critical Pressure; E-beam Parameter Variation; Delay Measurement

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4760
(SWITCHES, CLOSING)

(Gas Gaps, Optical)

EFFECTS OF SPARK GAP GEOMETRY AND LASER COMPONENTS ON THE LASER-TRIGGERED ELECTRIC BREAKDOWN

M. Pillaticker

Institut für Plasmaphysik, Garching, FRG

IEEE 2nd International Conference On Gas Discharge, pp 7-9 (01/1972).

Triggering spark gaps with laser light is superior to the conventional method of electrically triggering them in many fields of application. Investigations hitherto have provided only inadequate information on the influence of laser components and the spark gap geometry on the breakdown process. In order to complete the available knowledge on the subject and facilitate application of laser-triggered gaps, these parameters had to be optimized.

Triggering can then be achieved with minimum laser power, thus assuring economy of the triggering method, which is largely governed by the laser power. 11 Refs.

Primary Keywords: Geometry Considerations; Optimization; Axial Beam Propagation; Small Gap; Effect Of Gap Medium

COPYRIGHT: 1972 IEE

4761
(DIAGNOSTICS AND INSTRUMENTATION; POWER TRANSMISSION)

(E-fields; Cables)

ELECTRIC-FIELD DISTRIBUTION AROUND AN ISOLATED STRANDED CONDUCTOR

J.G. Andre and A.J. Sharples

Central Electricity Generating Board, London, UK

Proceedings Of The IEE, Vol. 119, No. 8, pp 162-166 (08/1972).

The authors present a method for calculation of the voltage and E-fields of stranded cable. Laplace's equation is solved analytically with the assumption that the r and theta components of the variation of potential are separable. The boundary conditions are then inserted numerically to give n equations in n unknowns. Example solutions are given, and the effect of stranding on corona is discussed. 10 Refs.

Primary Keywords: Stranded Wire; Field Calculation; Potential Calculation; Laplace's Equation; Analytical Solution; Numerical Boundary Solution

COPYRIGHT: 1972 IEE

4767
(PULSE GENERATORS)

(Plumlein Lines)

GENERATOR WITH AMPLITUDE AND LENGTH STABILIZATION OF THE PULSE FOR SUPPLYING A STREAMER CHAMBER

N.S. Rudenko and V.I. Tsvetkov

Tomsk Polytechnic Institute, Tomsk, USSR

Instruments And Experimental Techniques, Vol. 15, No. 2, pp 489-491 (04/1972).

Trans. From: Priroby i Tekhnika Eksperimenta 2, 94-96 (March-April 1972)

A generator producing pulses having an amplitude of 200 kV and a length of 16 nsec is described. The pulse length of such a generator is stable and is determined by the transit time of the leading edge of the wave in the shaping line. The amplitude of the pulses is stabilized by means of a three-electrode spark gap which allows operation on the flat portion of the charging pulse of an Arkad'yev-Marx generator. The results of tests performed on the generator showed that within the limits of the measurement error no scatter of the pulse amplitude or of the width of cosmic-particle tracks is observed. 5 Refs.

Primary Keywords: Plumlein Line; Spark Gap; Stable Pulse Length; Stable Pulse Amplitude; Marx Generator

Secondary Keywords: Streamer Chamber

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

4768
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

GROUNDED MONITOR FOR HIGH VOLTAGE ACCELERATORS

C.G. Crockett

Edwards High Vacuum International, Manor Royal, Crawley, Sussex, UK

Journal of Physics E: Scientific Instruments, Vol. 5, pp 753-754 (08/1972).

A simple apparatus is described which is used to monitor equipment in the high voltage terminal of a particle accelerator, and display the reading on a meter at ground potential. A servo mechanism is used to rotate an insulating rod coupled to a grounded potentiometer. The system, while being relatively inexpensive, provides an accuracy better than 1%. 1 Refs.

Primary Keywords: Voltage Monitor; Servo Mechanism; Insulated Mechanical Link; Low Frequency

Secondary Keywords: Particle Accelerator

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4773
(POWER CONDITIONING)
(Pulse Forming Lines)
HIGH-VOLTAGE GENERATOR PRODUCING SINGLE NANOSECOND PULSES ACROSS A VARIABLE LOAD

V.I. Manylov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 406-408
(04/1972).

Trans. From: *Pribory i Tekhnika Eksperimenta* 2, 91-93 (March-April 1972)

The construction of a generator which forms single pulses having an amplitude of up to 50 kV and a trailing-edge duration of 2 nsec and a length of from 3 nsec up is described. Due to the changing of the core of the shaping line the insulation conditions are considerably improved. The construction of a simple and reliable commutator with preliminary open-circuiting of the charging circuit of the shaping line is presented. 4 Refs.

Primary Keywords: Pulse Forming Line; Variable Pulse Length; Rectangular Pulse; Unmatched Load

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

4778
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

MODULATION OF THE TRANSMISSION FACTOR OF RESISTIVE DIVIDERS IN MEASURING A HIGH DC VOLTAGE

K.L. Grudev
Institute Of Electrical Welding, Academy Of Sciences Ukrainian SSR, Kiev
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 465-467
(04/1972).

Trans. From: *Pribory i Tekhnika Eksperimenta* 2, 138-140 (March-April 1972)

A method is described for measuring high-voltage electrical signals, which is based on modulating the transmission factor of a resistive DC voltage divider. The achievable accuracy of measuring the resistance and of performing the scale conversion of the dividers according to the method proposed is in the range from 0.001 to 0.1% for resistors of approximately 0.1 to 10 Gigaohm which convert voltages ranging from approximately 0.05 to 1 MV. 3 Refs.

Primary Keywords: Resistive Divider; Transmission Factor Modulation; DC Voltage; 0.001 percent Accuracy

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

4780
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems; Gas Gaps, Electrical)

MULTI-STAGE SYNTHETIC CIRCUIT FOR EXTRA-HIGH-VOLTAGE CIRCUIT-BREAKER TESTING

V. Zadic and G. St-Jean
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 3, pp 782-790 (06/1972).

A new synthetic testing circuit, intended mainly for E.H.V. circuit breaker tests is being described. Based on the well known idea of parallel current injection method, the circuit is created in the form of several, integrated stages. The adjustment of the circuit test voltage to the rated voltage of the tested breaker is made by connecting the stages in series, in parallel or in a series-parallel combination. This arrangement creates a special type of a combined current and voltage impulse generator. After describing the new circuit diagram and its operation, the authors give the results of the work accomplished to date. This includes an analysis of possible disturbances caused by improper triggering of the spark gaps, results of development of the spark gaps triggered via a light beam, by plasma guns, a short description of an experimental 3 stage circuit which is now prepared for tests and an outline of the final testing circuit for voltages up to 1500 kV and equivalent 3 phase symmetric interrupting capacity of 60,000 MVA at T.R.V. frequencies as low as 680 Hz. 5 Refs.

Primary Keywords: Multistage Pulse Generator; Series-parallel Operation; Modular Construction; Trigatron Gap; Optical Trigger Isolation

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

4786
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)

RANGE OF COMMUTATABLE VOLTAGES OF VACUUM SPARK GAPS

V.K. Bocharov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 14, No. 5, pp 1418-1419
(05/1971).

Trans. From: *Pribory i Tekhnika Eksperimenta* 14, 134-135 (September-October 1971)

The minimal commutable voltages and currents of vacuum spark gaps with evaporating walls are determined as a function of the parameters of the discharge tank and the inside diameter of the insulator which separates the high-voltage electrodes of the device. The results allow the working range of commutable voltages of spark gaps to be chosen, and the inside diameter of the main insulators of the spark gaps to be determined for a stipulated density and magnitude of the commuted current; they also allow certain spark-gap insulators to be cleaned without disrupting the vacuum-tightness or cleaning the device mechanically. 1 Refs.

Primary Keywords: Vacuum Gap; Evaporating Walls; Stable Operation; Inductive Loads; Capacitive Energy Store

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

4791
(BREAKDOWN STUDIES)
(Gas, Electrical)

STUDIES OF SPARK FORMATION AT HIGH SWITCHING VOLTAGES OF POSITIVE POLARITY

B.E. Genger and E.G. Maier
Brown, Boveri & Co Ltd, Baden, Switzerland
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 6, pp 2427-2436 (12/1972).

Studies of the development of pre-discharges with large air gaps and positive switching voltages of 1.5 and 2.0 MV are reported. Measurements of the charge flowing into the gap and recordings obtained with a high-resolution image converter have shown that the origin of the filamentary brush-like discharges moves forward at an almost constant rate of a few cm/microsecond, and that variations in luminosity are accompanied by similar fluctuations in the transfer of charge. The source behind the streamers remains without light except when a leader is formed for a short time in the event of a charge step. The discussion is illustrated by numerous photographs and oscillograms. 10 Refs.

Primary Keywords: Prebreakdown Development; Non-uniform Field Gap; Charge Transfer; Rod-plane Gap

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

4803
(BREAKDOWN STUDIES)
(Solid, Electrical)

UNIT FOR INVESTIGATING THE OPTICAL AND ELECTRICAL CHARACTERISTICS OF NANOSECOND BREAKDOWN OF CONDENSED MEDIA

V.V. Lopatin and V.Ye. Ushekov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 15, No. 1, pp 165-167
(02/1972).

Trans. From: *Pribory i Tekhnika Eksperimenta* 1, 146-146 (January-February 1972)

A unit is described containing a nanosecond generator producing pulses having an amplitude of 400 kV and a controllable length, a network for recording the pulse prebreakdown current having an amplitude 5-5 mA, an electron-optic shutter, and a light amplifier. The length of the voltage pulse can be controlled by a controllable clipping spark gap in which dielectric breakdown along the surface of a solid dielectric is used. The recordings of the prebreakdown current with compensation of the capacitive component is achieved using a bridge circuit based on Rogowski transformers. 9 Refs.

Primary Keywords: Insulation Breakdown; Solid Breakdown; Pulse Generator; Voltage Monitor; Current Monitor; Displacement Current Compensation; Optical Monitor

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

4805
(POWER CONDITIONING)

(Systems)

POWER CONDITIONING SYSTEMS FOR HIGH-POWER, AIRBORNE, PULSED APPLICATIONS

A.S. Gilmour Jr.
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Trans. Aerospace And Electron. Sys., Vol. AES-13, No. 6 pp 668-678 (11/1977).

The power conditioning portion of the high-power study that was performed for the Air Force Aeropropulsion Laboratory by the State University of New York at Buffalo is summarized. This effort defines the power conditioning system and critical components developments which will be required to interface the airborne 10-MW to 50-MW sources defined under separate study efforts with certain loads. Power conditioning systems are considered for use with magnetohydrodynamic generators and turbine driven alternators, both conventional and superconducting. The critical components required for each of the power conditioning systems are identified and then analyzed. The component analyses include estimations of development efforts necessary and of specific weights and volumes for components. The primary components considered are transformers (for alternator as well as for inverter use), switches, capacitors, and inductors. Weight algorithms are developed for each of the components. Following the component analyses, subsystems such as inverters and rectifier and filter packages are considered. The data for the various components and subsystems are utilized for a comparison of the power conditioning techniques to be used with the various power sources. The weights and volumes of power conditioning systems for 8-point designs (8 variations of power, voltage, duty cycle, and total run time) are derived. 23 Refs.

Primary Keywords: Transformer; Switch; Capacitor; Inductor; Light Weight; Subsystem

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

4806
(ENERGY STORAGE, INDUCTIVE)

(Systems)

0.56-MJ SUPERCONDUCTING MAGNETIC ENERGY TRANSFER AND STORAGE

J.D. Rogers (1), D.J. Blavins (1), J.D.G. Lindsay (1), G.A. Miranda (1), C.E. Swannack (1), D.M. Weldon (1), J.J. Wollan (2), C.J. Molla (2), E. Mullan (2), P.W. Eckels (2), H.E. Haller (2), M.A. Janocko (2), S.A. Karpathy (2), DC Litz (2), P. Reichner (2), Z.N. Sanjana (2) and M.S. Walker (2)

(1) Los Alamos National Labs, Los Alamos, NM 87545

(2) Westinghouse Electric Corp, Pittsburgh PA

LASL Report No. LA-UR-77-1312 (08/1977).

Availability: LA-77-1312

NITS

A superconducting energy storage coil designed to store 300 kJ of energy was operated with stored energy up to 0.54 MJ. The energy was transferred from the coil in periods from 1 to 2.4 ms. Hysteresis loss and losses from coil effects during pulsed energy transfers were observed. The coil is described and the test results are presented. Also included is a description of a METS (magnetic energy transfer and storage) driven adiabatic plasma compression system for a large toroidal theta-pinch reactor test and of a 300-kJ, monolithic conductor, superconducting pulsed energy storage coil. 27 Refs.

Primary Keywords: Superconducting Coil; Hysteresis Loss; Monolithic Conductor

Secondary Keywords: Theta-pinch

4819
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Gas Gaps, Materials)

CURRENT DENSITY IN ELECTRODE SPOTS OF ARC WITH METAL ELECTRODES

P.V. Sergeev and G.A. Shepel'
Journal Of Engineering Physics, Vol. 17, No. 6 pp 1589-1514 (12/1969).

Trans. From: *Inzhenerno-Fizicheskii Zhurnal* 17, 1041-1049 (December 1969)

The dependence of the total current density in the spots on its different components and the current is examined by considering the energy balance of the electrode sheathes. The factors affecting electrode erosion are determined. Results of measurements of the current density on spots on iron electrodes in arcs with different currents are given. 3 Refs.

Primary Keywords: DC Arc; Current Density; Graphitized Refractory Electrode; Metal Electrode; Electrode Sheath; Power Balance

COPYRIGHT: 1972 PLENUM PUBLISHING CORP., REPRINTED WITH PERMISSION

4831
(BREAKDOWN STUDIES)

(Gas, Electrical)

MEASUREMENT OF THE ELECTRON TEMPERATURE OF THE PLASMA OF A QUASI-STABLE

PULSED GLOW DISCHARGE IN SPARK GAPS WITH HIGH OVERVOLTAGES

V.V. Osinov, R.B. Bakht, Yu.I. Bychkov and A.G. Filimonov

Optics And Spectroscopy, Vol. 33, No. 5, pp 459-461 (05/1972).

A quasi-stable glow discharge in helium at 30 and 100 Torr is studied. The discharges for several electrode separations are analyzed spectroscopically and the results obtained are used to calculate the electron temperature of the plasma. Measurements taken of gap voltage and current allow the electron concentration to be calculated. 9 Refs.

Primary Keywords: Glow Discharge; Pulsed Discharge; Helium; Plane

Electrodes; Parallel Electrodes

COPYRIGHT: 1972 OPTICAL SOCIETY OF AMERICA

4878
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
STUDY OF A 40 KV MULTISTAGE SPARK GAP OPERATED IN AIR AT ATMOSPHERIC PRESSURE

A. Anvari and O. Steinvall
Institute Of Physics, University of Uppsala, Uppsala, Sweden
Journal Of Physics E: Scientific Instruments, Vol. 6, No. 11, pp 1113-1115 (07/1973).
The electrical properties of a multistage spark gap have been studied and a compact 40 KV four-stage switch is described. The switch can be operated in atmospheric air with a 50 ns delay time and a ~ 5 ns jitter, when triggered at breakdown voltage. Both these values are shorter, by a factor of 3, than those of a similar two-electrode spark gap. The discharge gaps, besides the electrical connection, have been coupled to each other, optically, by means of an axial hole through the switch. This coupling, which gives rise to a simultaneous ignition in the gaps, is mainly responsible for the reduction of the jitter and the delay time. The simultaneity of the gap ignitions has been shown by investigating the short-light pulses (about 2 ns halfwidth) emitted from the spark of each gap. The switch is also capable to work with high repetition rate. More than 1200 Hz with a 4 KA peak current has been obtained, when operating the switch in air at atmospheric pressure. 6 Refs.

Primary Keywords: Multistage Spark Gap; Four-stage Spark Gap; 5 NS Jitter; Optical Coupling; Repetition

COPYRIGHT: 1973 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

4875
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
THE EFFECT OF IONIZATION AND FLOW VELOCITY UPON SPARK GAP RECOVERY
R.M. Clements (1) and P.R. Smy (2)
(1) University of Victoria, Victoria, British Columbia, Canada
(2) University of Alberta, Edmonton, Alberta, Canada
Journal Of Physics D: Applied Physics, Vol. 6, No. 10, pp 1253-1265 (06/1973).

Breakdown measurements for a small cylindrical cathode in an atmospheric-pressure flowing plasma of variable ionization (between 1E15 and 1E18 m⁻³) are reported for both DC voltages and fast-rise pulses (rise time 0.16 microsecond) applied to the cathode. For these measurements the breakdown voltages are found to be reduced to as little as 1/6 of the breakdown voltage with no ionization. The measurements agree reasonably well with a theoretical model in which the anode is not the positive electrode in the plasma, but rather the edge of the coaxial sheath which surrounds the cathode, with breakdown voltages being given by the well-known breakdown relation for coaxial gaps. (For cylindrical geometry and a thick sheath, the ion space charge in the sheath is shown to change materially the electric field from its value calculated for a conventional coaxial gap of the same dimensions.) In this experiment the impedance of the plasma between the sheath edge and the actual positive electrode is low enough for breakdown not to occur over this region. It is expected that this model will be used to predict reignition voltages at short recovery times in circuit breakers. 15 Refs.

Primary Keywords: Breakdown Measurement; Flowing Plasma; Variable Ionization; DC Voltage; Impulse Voltage

COPYRIGHT: 1973 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

4880
(PULSE GENERATORS)
(Blumlein Lines)
THREE-ELECTRODE BLUMLEIN LINE FOR SUPPLYING A STREAMER CHAMBER
V.S. Chirchikin and S.B. Shavly
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instrumentation and Experimental Techniques, Vol. 15, No. 3, pp 1328-1330 (10/1972).
Trans. From: Pribyl'naia Tekhnika Ekspеримента 5, 38-40 (September-October 1972)

The construction of a Blumlein line and a shaping spark gap is described which produces pulses having an amplitude of 260 KV and a length of 13 nsec. 3 Refs.

Primary Keywords: Design Considerations; 25 Ohm Line Impedance; 50 Ohm Load Impedance; Marx Generator

COPYRIGHT: 1973 PLENUM PRESS. REPRINTED WITH PERMISSION

4887
(PULSE GENERATORS)
(Blumlein Lines)
A COMPACT HIGH SPEED LOW IMPEDANCE BLUMLEIN LINE FOR HIGH VOLTAGE PULSE SHAPING
J.H. Crouch and M.S. Risk
University of Maryland, College Park, MD 20742
The Review Of Scientific Instruments, Vol. 43, No. 4, pp 632-637 (04/1972).

Design, construction, and operation of a low impedance Blumlein line are presented. Glycerol was used as a dielectric to obtain a 14.5 ohm line which in conjunction with a Marx generator driver could produce 5 nsec long 260 KV pulses. The line, which is small enough to be housed in a Lucite box 30 cm wide x 30 cm long x 13 cm thick, was used to drive a beam of 760 ZV long, 50 cm wide x 7.62 cm gap streamer chamber. Properties of the Blumlein line with water as the dielectric are also given and limitations on further shortening of the pulse are discussed. 16 Refs.

Primary Keywords: Blumlein Line; Low Impedance; Glycerol Dielectric; Water Dielectric; Small Size

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

4889
(BREAKDOWN STUDIES)
(Gas, Electrical)
A COMPUTER SIMULATED MODEL FOR DIFFUSION AND DRIFT OF ELECTRONS IN FLASH TUBES

F.M. Holroyd and J.M. Breere
University of Durham, Durham, UK
Nuclear Instruments And Methods, Vol. 180, No. 2, pp 277-280 (04/1972).

A Monte Carlo method is used to solve the equation of diffusion and drift of electrons in a flash tube, taking into account the formative distance of the discharge. Hence the efficiency as a function of delay between the passage of an ionising particle and the application of the high voltage pulse is found, for different electron drift velocities. Comparison of experimental efficiencies with these results enables an estimate to be made of the electric fields built up in flash tubes when they are operated at high repetition rates. 14 Refs.

Primary Keywords: Flash Tube; Numerical Calculation; Monte Carlo Calculation; Electron Diffusion; Electron Drift; Repetition; E-field Buildup

COPYRIGHT: 1972 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

4890
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)
A CYLINDRICAL ELECTROSTATIC FLUXMETER FOR CORONA STUDIES

R.T. Waters
UMIST, Cardiff, UK
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 475-478 (05/1972).

The electric field at a high voltage electrode is modified by corona discharge in the space surrounding the electrode. A knowledge of the resultant magnitude of the electric field is of value in the theoretical analysis of the corona. Systems of cylindrical geometry are of particular importance because of applications in electrostatic precipitators and in power loss from overhead transmission lines. The earlier methods of field measurement in corona discharges have not been suitable for measurement of the field strength at the electrode surface in particular in the case of power lines. The paper describes a new technique involving a cylindrical rotating electrostatic fluxmeter. The device is capable of differentiating between conduction and displacement current when used as part of an active corona electrode. 11 Refs.

Primary Keywords: E-field Measurements; Corona; Cylindrical Geometry; Rotating Fluxmeter; Power Frequencies

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

4897
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
ALTERNATE POLARITY MULTIPLE SPARK GAP FOR HIGH EFFICIENCY SHOWER DETECTORS

C. De Marzo (1), L. Guarriero (1), C. Nicolini (1), F. Posse (1), G. Chen (2), C.R. Fletcher (2), R.E. Lenou Jr. (2), L. Rosengren (3) and R. Thorn (3)
(1) Universita di Bari, Bari, Italy
(2) Brown University, Providence, RI
(3) Massachusetts Institute of Technology, Cambridge, MA
Nuclear Instruments And Methods, Vol. 97, No. 3, pp 539-545 (12/1971).

The developments in the HV pulsing system which have been made in order to reduce the rise time and the delay of the HV pulse at the plates of a large spark chamber system are reported. Higher efficiency has been achieved reading each chamber through an alternate polarity multiple spark gap. 0 Refs.

Primary Keywords: Low Inductance; Stainless Electrode; Spark Plug Trigger; Alternate Polarity

Secondary Keywords: Spark Chamber

COPYRIGHT: 1971 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

4910
(SWITCHES, OPENING)
(Mechanical)
DIELECTRIC RECOVERY AND SHIELD-CURRENTS IN VACUUM-ARC INTERRUPTERS

C.W. Kieblin
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 3, pp 1261-1270 (06/1971).

Dielectric recovery data is presented following forced current interruption of a 1500 A copper vapor arc in a vacuum interrupter. At the first recovery periods during the first 6 to 25 microseconds following interruption, the instantaneous dielectric strength is determined by the application of high voltage step function pulses. This instantaneous dielectric strength is defined as the maximum voltage which can be consistently reappplied without causing reignition. The influence of electrode spacing (0.6 or 1.3 cm), shield potential and polarity of the reappplied voltage on the recovery of dielectric strength have been determined. The more rapid rate of recovery initially observed at long spacings is attributed to the lower mean inter-electrode vapor density immediately following interruption. Recovery is also more rapid for 'reverse' rather than 'same' polarity reapplication indicating surface effects. In particular the roughening of the cathode surface during arcing, post arc currents lead to an initial reduction of dielectric strength for 'reverse' reapplication with the vapor shield tied to the 'arcng-anode'. The mechanism of these post arc currents has been investigated by observations of the high ion currents which flow to a negatively biased shield during and immediately following arcing. 16 Refs.

Primary Keywords: Vacuum Arc; Copper Electrode; Dielectric Strength; Temporal Resolution; Variable Electrode Spacing; Variable Shield Potential

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

4914
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
EPOXY RESIN CHAMBER FOR HIGH VOLTAGE BREAKDOWN STUDIES IN HIGH VACUUM

B.R. Prabhakar and M.K. Mandopadhyay
Indian Institute of Science, Bangalore, India
Vacuum, Vol. 22, No. 2, pp 47-52 (02/1972).

As the study of electrical breakdown phenomena in vacuum systems requires maintenance of a thorough understanding of the breakdown mechanism at high voltages necessitates a chamber for experimental studies. An epoxy-resin chamber has been constructed by casting ring sections which were joined together. The advantages of such a chamber over the conventional metal or glass chamber are given especially as regards the electric field configuration, high voltage lead-in, and the ease of construction. Special facilities can be incorporated while constructing the chamber which makes it more versatile: for example, in pre-breakdown current measurements, electron beam focusing studies, etc. 5 Refs.

Primary Keywords: Vacuum Breakdown; Breakdown Chamber; Epoxy Resin Construction; Field Configuration

COPYRIGHT: 1972 PERGAMON PRESS. REPRINTED WITH PERMISSION

4917
(PULSE GENERATORS)

(Merx)
FIRING AND VOLTAGE SHAPE OF MULTISTAGE IMPULSE GENERATORS

F.W. Heilbronner
Hochspannungsinstut, Technical University, Munich, Germany
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 5, pp 2233-2238 (10/1971).

The calculation of electromagnetic transients is applied to an impulse generator circuit of n stages with the overall voltage behaviour of the spark-gaps taken into account. Measurements of the impulse voltage by a damped-capacitive divider and of the subsequent firing of the sphere gaps by streak photography with an image converter camera illustrate good agreement between equivalent model and actual circuit. 14 Refs.

Primary Keywords: Marx Generator; Experiment; Theory; Modeling; Analytical Calculation; Performance Prediction; Pulse Shape Prediction

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

4919
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)

FLASHOVER TESTS ON DUST-CONTAMINATED INSULATORS

F.A.M. Risk and A.A. Assaad
Electricity Corp., UAR
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 1, pp 328-335 (02/1972).

This paper describes a high voltage laboratory testing program of artificially dust-contaminated carbon pin insulators. Several factors are found to affect the flashover characteristics, including the method of voltage application, the rate of wetting of the contaminated insulators, and the duration of the high voltage test. The 50% flashover voltage is found to be proportional to the number of insulator units per string while the relative dispersion decreases considerably for longer strings, within the range investigated. Flashover characteristics of artificially and naturally contaminated insulators are compared. Due consideration is given to the statistical nature of the problem which determines the volume of the tests involved. Flashover values are shown to belong to a population characterized by a Gaussian distribution and a procedure for optimizing the number of necessary tests is developed. 16 Refs.

Primary Keywords: Surface Flashover; Surface Contamination; Cap Insulation; Pin Insulation; Artificial Contamination; Natural Contamination

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

4931
(SWITCHES, CLOSING)

(Gas Gaps, E-beam)

INITIATION OF A DISCHARGE IN A MEGAVOLT GAS SPARK GAP BY AN ELECTRON BEAM

E.A. Abramyan, V.V. Borob'ev, A.A. Egorov, V.A. Elkin and A.G. Ponomarenko
Nuclear Physics Institute, Academy of Sciences of the USSR, Novosibirsk Instruments And Experimental Techniques, Vol. 14, No. 1, pp 130-131 (02/1971).

Trans. From: *Pribory i Tekhnika Eksperimenta* 14, 117-118 (January-February 1971)

The preliminary results of experiments on the excitation of a discharge in a gas spark gap at high pressure by means of external injection of an electron beam are presented. The study of nanosecond initiation of megavolt gaps is designed for plasma research, work in the field of accelerators, and work in nanosecond engineering. 5 Refs.

Primary Keywords: E-beam Triggered Spark Gap; Delay Measurement;

Nitrogen Gap; Low Current Beam

COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION

4932
(BREAKDOWN STUDIES)

(Gas, Electrical)

IONIZING POTENTIAL WAVES AND HIGH-VOLTAGE BREAKDOWN STREAMERS

H.W. Albright and D.A. Tidman
University of Maryland, College Park, MD 20742
The Physics Of Fluids, Vol. 15, No. 1, pp 86-90 (01/1972).

The structure of ionizing potential waves driven by a strong electric field in a dense gas is discussed. Negative breakdown waves are found to propagate with a velocity proportional to the electric field normal to the wavefront. This causes a curved ionizing potential wavefront to focus down into a filamentary structure, and may provide the reason why breakdown in dense gases propagates in the form of a narrow leader streamer instead of a broad wavefront. 10 Refs.

Primary Keywords: Potential Wave; Negative Breakdown Wave; Filamentary Structure; Theory

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4933
(PULSE GENERATORS; SWITCHES, CLOSING)

(Trigger; Avalanche Transistors, Optical)

LASER-TRIGGERED AVALANCHE-TRANSISTOR VOLTAGE GENERATOR FOR A PICOSECOND STREAK CAMERA

S.W. Thomas and L.W. Coleman
Lawrence Livermore Lab., Livermore, CA 94550

Applied Physics Letters, Vol. 20, No. 2, pp 83-84 (01/1972).

Direct optical triggering of an avalanche transistor with a short laser pulse has been demonstrated. In some applications this system provides a compact laser-trigger replacement for a laser triggered spark gap. The technique has been applied to generating the gating and sweep voltages in a picosecond streak camera for laser pulse diagnostics where it eliminates the need for multiple beam splitters and long delays. The 'trigger' avalanche transistor was placed as one of a series string of avalanche transistors. A portion of the switch-out laser pulse to be diagnosed was focused onto the trigger transistor chip. Nanosecond-rise kilovolt waveforms are thus generated with time jitter of the entire system being less than 100 psec. 10 Refs.

Primary Keywords: Avalanche-transistor; Series String; Laser Trigger;

Subnanosecond Jitter; Nanosecond Trigger Energy

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4935
(PARTICLE BEAMS, ION)

(Generation)

PRODUCTION OF INTENSE DEUTERON BEAMS

J. Golden and C.A. Kapetanakes
Naval Research Lab., Washington, DC 20375

Applied Physics Letters, Vol. 28, No. 1, pp 3-6 (01/1976).

Results are reported on the production of 400-kev 50-nsec-duration 1.3-kA deuteron beams using a reflex triode. 11 Refs.

Primary Keywords: Ion Beam Generation; Reflex Triode; 1.3 kA Current;

Field-reversing Ion Layer; Ion Ring

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4941
(PULSE GENERATORS)

(Blumlein Lines)

OPERATIONAL EXPERIENCE WITH A PROTOTYPE FAST KICKER MODULATOR

M. Fruithman

Brookhaven National Lab., Upton, NY

IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 962-963 (03/1971).

The modulator built to test components for the proposed AGS fast kicker operated at 800 MH peak output for 1700 hours. Its unique circuit is described and the operating conditions are listed. The results of the testing of various high power components are discussed. 2 Refs.

Primary Keywords: Blumlein Line; Design Considerations; Performance

Test; Component Selection; Dummy Load Design

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

4944
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Electrical; Electrodes)

PERFORMANCE OF SPHERE AND ROD-ROD GAPS UNDER HIGH DIRECT VOLTAGES

A. Colombo and W. Mosca

CESi-Centro Elettrotecnico Sperimentale Italiano, Milan, Italy

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 2, pp 581-510 (06/1972).

Up to now there is no detailed study dealing with the problems concerning the measurements of the highest DC voltages. The sphere gap is the only device recognized and normally used, but there are many doubts on its behaviour, especially as far as the accuracy is concerned. Additional causes of uncertainty are related to correction factors for atmospheric conditions and to the exact knowledge of the characteristics of very high ohmic voltage dividers, for which a precise and therefore difficult calibration must be required. This paper reports the results of a research on the behaviour of the sphere-gaps. The performance of the rod-rod gap is also examined with a view to the possibility of using it as a measuring device. Finally the problem of defining a withstand test voltage is briefly discussed. 12 Refs.

Primary Keywords: DC Voltage; Sphere-sphere Gap; Rod-rod Gap; Voltage Measurement; Self-breakdown; Voltage Scatter; Variable Gap Spacing

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

4945
(SWITCHES, CLOSING)

(Gas Gaps, Optical)

PICOSECOND TRIGGERING OF A LASER-TRIGGERED SPARK GAP

R.J. Dewhurst, G.J. Part and S.A. Ramsden

University of Hull, Hull, UK

Journal Of Physics D: Applied Physics, Vol. 5, pp 97-103 (01/1972).

The characteristics of laser-triggered spark gaps, initiated by a switched-out pulse of about 7 ps from a mode-locked Nd-glass laser system, are investigated. The formation time delay of breakdown across the gap can be of the order of 1 ns and is found to increase as the gap voltage is reduced. Comparison with spark gaps triggered by Q-spoiled nanosecond laser pulses is made. Finally a comparison of the gap sizes in the experimental results and theory suggests that the initiation of gas breakdown is due to the production of only a few free electrons from the electrode surface on which the laser beam is focused. 15 Refs.

Primary Keywords: Nd-glass Laser; Mode Locked Laser; Single Triggering Pulse; Formative Time Lag; Experiment; Theory

COPYRIGHT: 1972 INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4946
(BREAKDOWN STUDIES)

(Gas, Electrical)

PREBREAKDOWN PHENOMENA IN STANDARD ROD GAPS SUBJECT TO IMPULSE VOLTAGES

J.E. Matthews and R. Saint-Arnaud

University of Strathclyde, Glasgow, Scotland

Proceedings Of The IEE, Vol. 118, No. 10, pp 1528-1534 (10/1971).

The authors consider the prebreakdown corona and leader formation for impulse voltages in this paper. The gap was a rod-rod gap with up to 30 cm spacing and applied voltage of 400 kV. The times to corona onset, leader formation, and main stroke were measured along with the number of current pulses (to be correlated with leader steps).

From this, the average voltage at corona onset, propagation speeds of corona and leaders, and average leader step length were derived. 28 Refs.

Primary Keywords: Corona; Leader Step Corona Voltage; Impulse Voltage; Rod-rod Gap

COPYRIGHT: 1971 IEE

4950
(PARTICLE BEAMS, ELECTRON)

(Generation)

RELATIVISTIC BRILLOUIN FLOW IN THE HIGH NU/GAMMA DIODE

J.M. Creedon

Physic International Co., San Leandro, CA 94577

Journal Of Applied Physics, Vol. 46, No. 7, pp 2946-2955 (07/1975).

Relativistic Brillouin solutions have been derived for electron flow in crossed electric and magnetic fields. The application of these solutions to the high nu/gamma diode is discussed and an approximate analytical expression for the anode current is derived. Measurements of diode current are compared to the theoretical and empirical expressions for diode current which have been developed. 39 Refs.

Primary Keywords: Field Emission Diode; Electron Flow; Brillouin Flow;

Magnetic Fields; Experiment; Theory

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4960
(BREAKDOWN STUDIES)

(Gas, Electrical)

THE FORMATION AND GROWTH OF A STABILIZED SPARK DISCHARGE

J.P. Walters

University of Wisconsin, Madison, WI

Applied Spectroscopy, Vol. 26, No. 3, pp 323-334 (06/1972).

Experiments are described in which stabilized spark discharges in nitrogen and argon at atmospheric pressure are studied. The discharges were generated by a quasi-wave current injection spark source operating up to 300 nsec. Optical spectrometers, photoelectric detection systems, and forming cameras were used to examine the formation of the plasma, the growth of the current flow, and the radiance of the spark. An analysis of discharge formation mechanisms involving metastable argon is presented. Electrode erosion is also discussed. 39 Refs.

Primary Keywords: Atmospheric Pressure Discharge; Nanosecond Time

Scale; Space Charge; Electrode Erosion; Spectral Output; Metastable Argon

COPYRIGHT: 1972 SOCIETY OF APPLIED SPECTROSCOPY

4963
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

THE LASER TRIGGERED SPARK GAP

S.H. Khan and D. Phil
University of Oxford, Oxford, UK
The Radio And Electronic Engineer, Vol. 41, No. 10, pp 475-480
(08/1971).

There is considerable interest in switching high voltages in the range of 10-1000 kV, with the minimum of delay and jitter. Delays of a few nanoseconds with assured reasonable freedom from jitter are of considerable importance in work requiring synchronization, such as the pulsed line acceleration of electron rings. The general requirements of a spark-gap switch are two-fold: (a) it must be able to take the full voltage applied to it; and (b) it must be able to conduct on demand. For this it is necessary that enough primary electrons be present to initiate the discharge and the gap voltage must be sufficiently high. The primary electrons are generally provided by ultraviolet or other irradiation of the gap, while a third or fourth trigger electrode is used to supply a voltage pulse that would disturb an existing voltage distribution and provide sufficient gap voltage. Such methods work quite well up to 70-80 kV, beyond which the problems posed by proper insulation and voltage division are quite enormous. The laser offers an alternative trigger device which is basically safe and simpler to use as it is isolated electrically from the spark gap. Moreover, a two-electrode configuration has obvious advantages from the engineering design point of view. 22 Refs.

Primary Keywords: Air Gap; Variable Gap Spacing; Experiment; Theory

COPYRIGHT: 1971 THE INSTITUTION OF ELECTRONIC AND RADIO ENGINEERS

4978
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx: Marx Generators)

500-KV IMPULSING GENERATOR
A.I. Pavlovskii, V.S. Besomykin, A.I. Gerasimov and A.P. Klement'ev
Instruments And Experimental Techniques, Vol. 14, No. 6, pp 1075-1077
(08/1971).

Trans. From: Pribory i Tekhnika Eksperimenta 4, 112-114 (July-August 1971).

A 10-stage Arkad'ev-Marx generator is described having a coaxial discharge impulsive circuit with a maximum voltage of 500 kV; the generator serves as the power supply for a high-current electron gun. The inductance of the generator is 1.2 microhenrys. The spark gap of the first stage is gas-filled ($N_2/Ar/2$, approximately 5 atm), while the subsequent spark gaps are air gaps; five triatrons with automatic firing from the operation of the preceding stage, and four two-electrode spark gaps. The duration of the flat top of the output pulse is controlled by a cutoff spark gap. The time distribution of the breakdown of the spark gaps is given, as well as the dependence of the generator operating time on the number of triatron spark gaps. 4 Refs.

Primary Keywords: Marx Generator; 500 KV Output Voltage; Rectangular Pulse; Spark Gap; 10 ns Rise Time

COPYRIGHT: 1972 PLenum Press, REPRINTED WITH PERMISSION

4977
(PARTICLE BEAMS, ELECTRON)
(Generation)

A NEW DIODE FOR THE PRODUCTION OF HIGH POWER RELATIVISTIC ELECTRON BEAMS
M. Friedman
Cornell University, Ithica, NY 14850
The Review Of Scientific Instruments, Vol. 42, No. 8, pp 1255-1256
(08/1971).

A new type of low impedance diode has been developed to produce pulsed relativistic electron beams. Using a multicathode system, the diode impedance was lowered to approximately 4 ohm. Currents of approximately 60 kA and voltages of approximately 250 kV have been obtained. 7 Refs.

Primary Keywords: Low Impedance Diodes; Multicathode System; Foilless Diodes

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4983
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)

A SPARK GAP MONITOR

D. Brown
Los Alamos National Labs, Los Alamos, NM 87555
The Review Of Scientific Instruments, Vol. 42, No. 9, pp 1287-1291
(09/1971).

A relatively simple method for determining the delay of many electrical signals with respect to a common trigger (e.g., in capacitor banks) is described. Using the well known principle of time-to-pulse-height conversion, a low-leakage polystyrene capacitor is charged to a voltage proportional to the delay. A read relay is used to scan the capacitors from the charging circuit, which permits the charge to be maintained on the capacitor for many seconds. Another read relay is employed to connect each capacitor to an ADC when it is desired to digitize the charge on the capacitor. A change in delay of less than 1 nsec (with a full scale of 200 nsec) is reliably detected for many hundreds of signals at a parts cost of less than \$10 per signal. 0 Refs.

Primary Keywords: Signal Delay Measurement; Capacitor Charging;

Time-to-pulse-height Conversion

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4990
(INSULATION, MATERIAL)
(Solid)

COMPARISON OF TRACKING TEST METHODS

M. Kurtz
Ontario Hydro Research, Toronto, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 2, pp 76-81
(06/1971).

A selection of epoxy specimens has been subjected to a number of different tests for track resistance. The degree of agreement between testing agencies using the same method, and between the different test methods is described. Generally speaking, those methods which impose alternate wet-dry cycles, or otherwise simulate the "dry-banding" effects that occur in service appear to classify materials in the correct order, that is, in best agreement with each other, and with actual outdoor performance. The superior track resistance of cycloaliphatic systems, and the further improvement consequent upon the use of hydrated alumina filler are confirmed. Details of the Tracking Endurance Wheel Test method are given in the Appendix. 4 Refs.

Primary Keywords: Insulation Tracking; Epoxy Resin; Several Specimens; Dry Banding; Cycloaliphatic Material; Outdoor Operation; Power Line Frequency

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

4998
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

EFFECT OF CATHODE MATERIAL IN A LASER TRIGGERED SPARK GAP

S.H. Khan and D. Welsh
University of Oxford, Oxford, UK

Journal Of Physics D: Applied Physics, Vol. 4, pp 344-347 (16/1970).

The use of refractory material like tungsten for the target electrode causes faster switching of a laser triggered spark gap. This is believed to be due to the faster local heating to a higher temperature which causes a greater injection of plasma into the gap. Reliable switching with a formative time of less than 10 ns has been achieved. 4 Refs.

Primary Keywords: Refractory Electrode Material; Faster Local Heating; More Plasma; Faster Switching

COPYRIGHT: 1970 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

4999

(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS; SWITCHES, OPENING)
(Rotating Machines; Systems; Mechanical)

FAST CIRCUIT BREAKER FOR THE DISCHARGE OF A STORAGE INDUCTOR

E.K. Inail
Australian National University, Canberra, Australia

Nature Physical Science, Vol. 231, No. 22, pp 111-112 (05/1971).

The authors report a scheme to transfer energy from a homopolar generator to a resistive load. The homopolar generator is discharged into an inductor to be discharged into a load. The heart of the apparatus is a switch/fuse combination that allows a power multiplication of over 200 when opened. 2 Refs.

Primary Keywords: Homopolar Generator; Toroidal Inductor; Mechanical Circuit Breaker; Fuse; Resistive Load; Power Multiplication

COPYRIGHT: 1971 MACMILLAN JOURNALS LTD.

5027

(POWER CONDITIONING)
(Pulse Transformers, Materials)

REVIEW OF MAGNETIC PROPERTIES OF Fe-Ni ALLOYS

G.Y. Chin
Bell Labs, Murray Hill, NJ 07747

IEEE Transactions On Magnetics, Vol. Mag-7, No. 1, pp 102-113 (03/1971).

During the past two decades, improved understanding of the fundamental magnetic behavior of Fe-Ni alloys has made them one of the most versatile class of soft magnetic materials. No longer is the concern limited to high permeability and low coercive force at room temperature. Alloys have now been custom-crafted to meet high permeability requirements at cryogenic temperatures, exhibit a skewed hysteresis loop for pulse transformer use, or a square hysteresis loop combined with stress insensitivity and controlled coercive force for memory applications. These examples are discussed in terms of the relationship of magnetic properties to structure and composition in Fe-Ni alloys. 90 Refs.

Primary Keywords: Fe-Ni Alloy; Room Temperature; Cryogenic Temperature; Skewed Hysteresis Loop; Pulsed Transformer

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

5033
(PULSE GENERATORS)
(Trigger)

SPARK GAP TRIGGER AMPLIFIER WITH 1-MSEC RECOVERY TIME

C.C. Lo
Lawrence Berkeley Lab, Berkeley CA

Nuclear Instruments And Methods, Vol. 92, No. 2, pp 299-308 (03/1971). A spark-gap trigger amplifier with 1-msec recovery time has been developed for experiments using spark chambers with fast recovery time. The system utilizes a spark gap operating under the ambient pressure as the high-current fast switching element, and is entirely self-contained. The system is capable of operating at 1 kHz for 1 sec burst, or 400 Hz continuously. 0 Refs.

Primary Keywords: Trigger Amplifier; 8-kV Output Pulse; Leakage Current; Field Distortion Spark Gap; Corona Lamp

COPYRIGHT: 1971 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

5045

(SWITCHES, CLOSING)

(Gas Gaps, Recovery)

THE INFLUENCE OF FORMATIVE TIME LAGS ON SPARK-GAP RECOVERY MEASUREMENTS

F.L. Curzon and M.S. Gautam

University of British Columbia, Vancouver, British Columbia, Canada

Journal Of Physics D: Applied Physics, Vol. 4, No. 2, pp 341-343 (02/1971).

This note shows that the observed lack of density variations for formative time lags of sparks can be explained by the known pressure and electric field dependences of the first Townsend ionization coefficient and the electron drift velocity. It is demonstrated that the lag depends linearly with gap length and inversely with the fraction over-voltage across the spark gap (in agreement with the measurements of Blair and Farish). Finally, it is demonstrated that the accuracy of the error in the measured 'restriking' voltage for a recovering spark channel is constant for the complete recovery period. 11 Refs.

Primary Keywords: Formative Time Lag; First Townsend Coefficient; E-field Dependence; Pressure Dependence; Recovery Time; Restrike Voltage

COPYRIGHT: 1971 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5047

(INSULATION, MATERIAL)

(Solid)

THERMAL EROSION OF ELECTRICAL INSULATING MATERIALS

M.J. Billings (1), L. Warren (2) and R. Wilkins (3)

(1) British Oxygen Co., Crawley, Sussex, UK

(2) University of Manchester, Manchester, UK

(3) University of Ankara, Ankara, Turkey

IEEE Transactions On Electrical Insulation, Vol. EI-6, No. 2, pp 82-90 (06/1971).

The erosion of synthetic insulating materials by surface discharges constitutes an important problem in the application of these materials for high-voltage outdoor applications. A method of erosion testing is described that simulates the heat flux from surface discharges by radiant energy from a thermal imaging source. This permits accurate measurement of erosion. A theory of erosion is developed that is found to agree well with experiments performed on several cyclolinic epoxy resin systems. 0 Refs.

Primary Keywords: Cyclolinic Epoxy Resin; Surface Tracking; Thermal Erosion; Thermal Imaging Device; Experiment; Theory

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

5848
(BREAKDOWN STUDIES; PARTICLE BEAMS, ELECTRON)
(Solid, Electrical; Generation)
TRANSIENTS IN LARGE TANDEM ACCELERATORS
P.H. Rose (1) and H. Milda (2)
(1) High Voltage Engineering Corp., Burlington, MA
(2) Ion Physics Corp., Burlington, MA 01803
IEEE Transactions On Nuclear Science, Vol. 18, No. 3, pp 63-67
(03/1971)

The stored energy in DC accelerators capable of reaching terminal potentials of 30 or 40 MV is more than an order of magnitude greater than in existing machines. To analyze the concentration of electrical fields under surge conditions the accelerator has been modeled by lumped constant networks. The analysis shows that in structures similar to the present ones the voltage distribution during a surge is very uneven and micro-discharges in the tube can initiate complete accelerator collapse. 10 Refs.

Primary Keywords: Accelerator; Modeling; Stored Energy; Fault Analysis; Circuit Approach

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

5853
(SWITCHES, CLOSING)
(Gas Gap, Optical)
A SIMPLE LASER-TRIGGERED SPARK GAP WITH SUBNANOSECOND RISETIME
A.J. Alcock, M.C. Richardson and K. Leopold
National Research Council, Ottawa, Ontario, Canada
The Review Of Scientific Instruments, Vol. 41, No. 7, pp 1028-1029
(07/1970)

The construction and operating characteristics of a pressurized laser-triggered spark gap capable of switching voltages exceeding 10 kV with a rise time of less than 300 psec are described. Other desirable features are its low delay and jitter times (approximately 1 nsec), the ability to deliver rectangular pulses with less than 10% ringing and gated off the pulse, and its simplicity of construction. The gap has been investigated using the output of either a single mode ruby laser or a mode-locked Nd-glass/mirror/glass laser as a trigger. 7 Refs.

Primary Keywords: Ruby Laser; Nd-glass Laser; Low Delay; Low Jitter; High Pressure Gap; Nitrogen Gas

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5864
(SWITCHES, CLOSING)
(Gas Gap, Electrical)
HIGH-CURRENT 60 KV MULTIPLE-ARC SPARK GAP SWITCH OF 1.7 MH INDUCTANCE
T.E. James
Culham Lab, Abingdon, Oxfordshire, UK
Proceedings Of The IEE, Vol. 117, No. 7 pp 1448-1452 (07/1970).

A multichannel spark gap is described. Multiple trigger pins are utilized to produce a switch with 1.7 mH effective inductance at 60 kV operating voltage. Very low jitter is a valuable side effect of the multiple trigger arrangement. Two trigger arrangements are described: a single circuit supplying all trigger pins, and an arrangement with one trigger circuit for each trigger pin. Both arrangements are shown to have advantages and disadvantages for certain applications. The effects of the variation of several circuit parameters (trigger voltage, gap voltage, load impedance, etc.) are described. 8 Refs.

Primary Keywords: Multichannel Spark Gap; Field Distortion Gap; Experimental Theory; Low Inductance; Low Jitter; Performance Test

COPYRIGHT: 1970 IEE

5881
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
KERR COEFFICIENTS OF POLYCHLORINATED BIPHENYLS AND CHLORINATED NAPHTHALENE

M. Misakian and R.E. Hebner Jr.
National Bureau of Standards, Washington, DC 20235
Journal Of Applied Physics, Vol. 47, No. 9, pp 4052-4055 (09/1976).

The electro-optic Kerr coefficients of two polychlorinated biphenyls and chlorinated napthalene have been measured to an accuracy of ten-⁻⁷ using a comparative technique. Physical properties of the fluids relevant to application in electro-optic devices are discussed. 22 Refs.

Primary Keywords: Kerr Coefficient Measurement; Polychlorinated Biphenyl Kerr Coefficient; Napthalene Kerr Coefficient; General Measurements; Dielectric Strength Measurements

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5882
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)
ELECTRICAL ENGINEERING (SELECTED ARTICLES)

E.S. Korolev, L.A. Sukhanov and G.A. Karmanov
FTD Report No. FTD-IDCR57-0663-80, 05/1980.
Trans. From: Elektrotekhnika 10, 45-48 (October 1969) By R. Potts
Availability: FTD-IDCR57-0663-80
HTIS

This document contains two articles translated from Russian concerning the design, construction, and application of homopolar generators. The first reports the analysis of an acceleration transducer. The acceleration transducer, which is essentially a homopolar generator working in a mode close to short circuit, is analyzed in detail. The second article reports on the design and construction of a homopolar generator. Special attention is devoted to the use of sodium-potassium as the contact medium and to the design and construction of the stator rings. 6 Refs.

Primary Keywords: Homopolar Generator; Acceleration Transducer; Liquid Metal Contacts. Analysis; Construction

5093
(BREAKDOWN STUDIES)
(Gas, Electrical)
ELECTRICAL AND PHOTOGRAPHIC MEASUREMENTS OF HIGH-POWER ARCS
G.R. Jordan, B. Bowman and D. Wakelam
British Steel Corp, Moorgate, Rotherham, Yorkshire, UK
Journal Of Physics D: Applied Physics, Vol. 3, No. 7, pp 1089-1099
(07/1970).

The nature and behaviour of free-burning arcs between a graphite electrode and a molten steel pool at current levels up to 10 kA, rms, and associated powers of 1 MW, has been determined from electrical measurements and high-speed photographs. The dimensions, mobility and electrical properties of these arcs are reported for the half-cycles when the graphite electrode is the cathode. Similar measurements were not possible for the alternate half-cycles because of the complex arc forms present. Some information on the velocities, electron conductivity and energy-loss processes of these arcs was obtained by considering the steady-state characteristics in the electrode-cathode half-cycles. It was concluded that the electrical conductivity was influenced, to a large extent, by the low ionization potential vapours evolved from the steel and graphite surfaces and that the main net energy loss from these arcs was by convection associated with the plasma jet streaming towards the steel surface. Radiation playing a smaller but still significant role. Surprisingly, thermal conduction appears to be almost negligible as a mode of energy loss. 16 Refs.

Primary Keywords: High-current Arc; Graphite Cathode; Molten Steel Pool Anode; Half-cycle; Power Line Frequency; Conductivity Measurement; Thermal Conduction

COPYRIGHT: 1970 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5098
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Surface Flashover)
INFLUENCE OF AIR DENSITY ON FLASHOVER VOLTAGES OF AIR GAPS AND INSULATORS
T. Marada (1), Y. Aoshima (1), Y. Ishida (2), Y. Ichihara (2), K. Anjo (3) and N. Mimura (3)
(1) Central Research Institute of The Electric Power Industry, Tokyo, Japan
(2) Tokyo Electric Power Co., Inc., Tokyo, Japan
(3) Chubu Electric Power Co., Inc., Nagoya, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-89, No. 6, pp 1192-1202 (08/1970).

Flashover tests were conducted with the cooperation of the Central Research Institute of Electric Power Industry, the Tokyo Electric Power Company, Inc., and the Chubu Electric Power Company, Inc., at the top of Mount Hyugase, 1850 meters above sea level and the Takeyama Laboratory, nearly at sea level, to obtain comparative data to evaluate the influence of air density on the flashover voltages of air gaps and insulators. From these tests results, the following relation between flashover voltage and air density was derived. The 50-percent flashover voltage at relative air density $d/\text{sub }1$, and absolute humidity $h/\text{sub }1$ on an air gap of spacing d is equal to the value at relative air density $d/\text{sub }2$, and absolute humidity $h/\text{sub }2$ as $d/\text{sub }2 = d/\text{sub }1 \cdot h/\text{sub }1/h/\text{sub }2$. The gap of spacing $(d/\text{sub }1 + d/\text{sub }2)/2$. From the relation between the 50-percent flashover voltage and the gap spacing at relative air density 1.0, the 50-percent flashover voltage at any relative air density can be determined by using the relation set forth above. 12 Refs.

Primary Keywords: Long Air Gaps; Variation Of Breakdown; Voltage With Altitude; Empirical Formula; Humidity Dependence

COPYRIGHT: 1970 IEEE, REPRINTED WITH PERMISSION

5102
(SWITCHES, CLOSING)
(Gas Gap, Optical)
LOW-JITTER MULTIGAP LASER-TRIGGERED SWITCHING AT 50 PPS
A.H. Guenther, J.R. Bettis, R.E. Anderson and Wick, R.V.
AFML, Kirtland AFB, NM 87117
IEEE Journal Of Quantum Electronics, Vol. QE-6, No. 6, pp 492-495
(08/1970).

Results on the simultaneous initiation of four high-voltage spark gaps by a single moderate power laser system are presented. A Q-spooled YAG laser irradiated each of four 50-kV spark gaps with 10-23 mJ energy in a 7-nsec pulse full-width at half maximum (FWHM) by use of simple beam-splitting techniques. Synchronization of approximately 0.1 ns at repetition rates as high as 50 pps was demonstrated both on electrically well-isolated switches as well as in a single switch in parallel with less than 1-ns time isolation. A unique synchronization indicator is described for use as a performance diagnostic. 20 Refs.

Primary Keywords: YAG Laser; Triggering Of Several Gaps; Tens Of MJ Energy; Tenth Nanosecond Synchronization; Transistor Isolation; Rep Rate

COPYRIGHT: 1970 IEEE, REPRINTED WITH PERMISSION

5103
(PARTICLE BEAMS, ION)
(Generation)
THEORY OF INTENSE ION BEAM ACCELERATION
T.M. Antonson Jr. and E. Ott
Cornell University, Ithaca, NY 14850
The Physics Of Fluids, Vol. 19, No. 1, pp 52-59 (01/1976).

The application of high voltage pulse power techniques to the production of intense ion beams is of great interest for plasma confinement, plasma heating, and pellet implosion. The main problem is that application of a high voltage to a simple anode-cathode gap will draw both an electron current from the cathode and an ion current due to the anode, and the electrons will receive most of the impulsion due to the smaller mass. Two methods of efficient intense ion beam production are considered: (1) the magnetically insulated diode and (2) the 'reflex-triode.' The relativistic equilibrium, the ion current dependence on accelerating voltage, its dependence on applied magnetic field (in the first method), and its variation due to a velocity distribution of the electrons (in the second method) are determined. For both methods the ion current can be substantially enhanced with respect to the Langmuir-Child current due to the presence of the negative electron space charge. In the case of magnetic insulation this enhancement increases as the magnetic field is lowered and diverges as it approaches the critical value past which electrons can traverse the gap. For the reflex triode the enhancement is increased by relativistic electron effects and by a population of electrons with energies less than the full voltage across the gap. 18 Refs.

Primary Keywords: Ion Beam Generation; Magnetically Insulated Diode; Reflex Triode; Ion Current; Electron Current

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5104
(POWER CONDITIONING)
(Peaking Gaps)

LOW-VOLTAGE SPARK PEAKER

D.S. Kolegov and V.A. Pogozhev
Moscow State University, Moscow, USSR
Instruments And Experimental Techniques, No. 3, pp. 677-679 (05/1969);
Trans. From: *Pribory i Tekhnika Eksperimenta* 3, 130-133 (May-June 1969).
A spark peaker for shaping pulses of approximately 1 kV is
described and the results of a test of its performance are
considered. The spark peaker operates periodically and shapes pulses
with a rise time of 0.5 ns, a 0.1 nsec and a triggering-time
instability of 0.15-0.2 nsec. 7 Refs.

Primary Keywords: Spark Gap; Peaking Gap; 1 kV Voltage; Subnanosecond
Rise Time; Air Gap

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

5106
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)

MULTICHANNEL VACUUM SPARK GAP
A.I. Baberitskii, B.A. Demidov, S.D. Fanchenko and V.V. Frolov
Institute Of Atomic Physics, Moscow, USSR
Instruments And Experimental Techniques, No. 3, pp. 718-720 (05/1969);
Trans. From: *Pribory i Tekhnika Eksperimenta* 3, 167-169 (May-June 1969).
A two-electrode vacuum spark gap having the configuration of a
slot in a dielectric with three firings distributed along the
electrodes is studied with a high-speed electron-optical camera. It
is shown that over the wide voltage range of 10-90 kV all three
current channels develop simultaneously, which reduces inductance to
a minimum. 6 Refs.

Primary Keywords: Three Channel Operation; Plasma Gun; Three Guns; Low
Jitter; Holdoff Voltage Reproducibility

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

5119
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

A NEW HIGH-VOLTAGE TRIGGERED SPARK GAP

T.E. Broadbent
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 15, pp. 97-99 (01/1964).
The trigatron type of spark gap and the hot-wire gap are combined
into a single device in which a trigger spark is produced near a
heated filament at the sparking surface of one main electrode. The
breakdown voltage of the gap, when triggered, is considerably lower
than the corresponding breakdown voltage for the two constituent gaps
separately provided the applied voltage is negative. By adjusting
the wire temperature the range of voltage over which satisfactory
triggering occurs can be controlled, without the need to adjust the
gap spacing. 6 Refs.

Primary Keywords: Trigatron Gap; Hot-wire Trigger; Combination;
Polarity Effects; Wide Voltage Range

COPYRIGHT: 1964 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5120
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)

A SURVEY OF EFFECT OF SURFACE PROPERTIES ON ANODE EROSION

N.S. Raser
Aerospace Research Labs, Wright-Patterson AFB, OH
No. ARL-68-8069, 29pm (04/1968).
Availability: AD-671 503
NTIS

Anode erosion is a serious problem in high power electric arcs and
appears to be due primarily to intense local heating. Three means
are considered for amelioration: improved heat transfer from the
anode spot, broadening of the anode spot (decreased power density),
and reduction of total anode power dissipation. Low work function
'patches' may create preferred arc attachment points. Surface
composition, structure and orientation can have major influence, and
means are discussed for tailoring anode surface properties. (Author)

Primary Keywords: Gas Discharges; Anodes; Electron Tubes;
Anodes (Electron Tubes); Erosion; Electric Arcs; Heat
Transfer; Surface Properties; Work Functions;
Adsorption

5143
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)

AN AUTOMATIC ELECTRIC FIELD MEASURING EQUIPMENT OF VERY HIGH RESOLUTION
AND ITS APPLICATION FOR THE STUDY OF ACOUSTOELECTRIC PHENOMENA

T. Zoldi
McGill University, Montreal, Canada
The Review Of Scientific Instruments, Vol. 44, No. 4, pp. 408-414
(04/1973).

An electric field measuring equipment with a capacitive probe of
40 micron resolution was constructed using only ordinary materials
and techniques. The operation of this equipment was completely
automatic and the electric field profiles were recorded continuously
by an x-y recorder. The duration of one measurement, consisting
typically of the recording of about 50 profiles and of the sample
current vs. time diagram, in 4 mm long samples, was approximately 50
min. The usefulness of this equipment has been proven through its use
for the observation of large-scale quasi-electrostatic field domain
formations in photoconductive CdS samples. The detailed description
of these observations will be reported elsewhere. 16 Refs.

Primary Keywords: Capacitive Probe; 40 Micron Resolution; Design
Considerations; Operation Considerations

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

5154
(ENERGY STORAGE, INDUCTIVE; ELECTROMAGNETIC FIELD GENERATION; SWITCHES,
OPENING)
(Systems; Magnetic; Superconductive)

HIGH MAGNETIC FIELD PRODUCTION FOR ELECTROMAGNETIC ENERGY STORAGE IN A
SUPERCONDUCTING COIL

A. Mairrie (1), A. Fortini (1), M. Huissier (2) and M. Sauzade (2)
(1) Universite de Caen, Caen, France
(2) Faculte Des Sciences D'Orsay, Orsay, France

Review Of Scientific Instruments, Vol. 45, No. 10, pp. 1464-1467
(10/1973).

A new method to produce high pulsed magnetic fields has been
developed. Capacitors generally used for the storage of energy have
been replaced by a superconducting coil which requires less space and
lower operating cost. The choice for the different elements of the
setup is discussed. A low energy model has produced a field of 20
tesla's with a time constant of 10 msec.

Primary Keywords: Magnetic Field Generation; Inductive Energy Storage;
Superconducting Coils; Superconductor; Timing/Control; Opening
Switches; Design Considerations; Low Energy Protective

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

5156
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

TRIGGERING OF A PRESSURIZED SPARK GAP BY A LASER BEAM

F. Deutsch
CERN, Geneva, Switzerland
Journal Of Physics D: British Journal Of Applied Physics, Vol. 1, pp.
1711-1719 (03/1968).

A delay line was discharged into a terminating resistor by a spark
gap of coaxial design. This spark gap was triggered by a focussed
laser beam introduced along the axis. A stretched ruby laser giving
pulses of 20 nsec duration and up to 50 MW power was used. The range of
operation of the gap, formative time of the breakdown and jitter were
investigated for different gases at pressures above atmospheric, gap
widths of 4-10 mm and voltages of up to 120 kV. Mixtures of argon and
nitrogen were found to have certain advantages, such as a low
threshold for ionization by the laser beam, sufficient dielectric
strength, low values of the formative-time jitter and chemical
inertness. Formative times of down to about 1 ns and jitters below 1
ns were found. The laser power can be relatively low (0.5-5 MW). An
explanation for the breakdown mechanism is proposed. 5 Refs.

Primary Keywords: Ruby Laser; Coaxial Spark Gap; Jitter Measurement;
Delayed Measurement; High Gap Pressure; Breakdown
Mechanism

COPYRIGHT: 1968 INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5158

(DIAGNOSTICS AND INSTRUMENTATION)
(Volts)

A PRECISION MEGOHM RATIO UNIT FOR HIGH VOLTAGE MEASUREMENTS

J.N. Harris
California Institute of Technology, Pasadena, CA
Review Of Scientific Instruments, Vol. 23, No. 8, pp. 409-413 (08/1952).

A precision megohm ratio unit consisting of 100 resistance units
wound of manganin wire is described. Stability of the order of a few
parts per million is achieved through careful construction.
Variations due to temperature changes are reduced by operating the
resistor in a circulating oil bath maintained at a temperature of 33
deg.C, where the temperature coefficient of the resistor is
essentially zero. The resistor is capable of continuous operation at
a potential of 3 kV and intermittent operation to 25 kV. A general
method is also reviewed for setting up accurate resistance ratios by
connecting two groups of resistors in appropriate series and parallel
arrangements. Employing this method and using the units of the
described megohm ratio unit, high ratios, consistently accurate to
one part per million, have been set up. 6 Refs.

Primary Keywords: DC Voltage Measurement; Modular Construction; High
Precision; Medium Voltage

COPYRIGHT: 1952 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

5161

(PARTICLE BEAMS, ELECTRON)
(Generation)

ANALYSIS OF TRANSMISSION-LINE ACCELERATOR CONCEPTS

J.K. Temperley and D. Eccleshall
Army Armament Research and Development Command, Aberdeen Proving Ground,
MD 21005

Final Rep. Nov 76-Sep 77 No. ARBRL-TR-02067, 58p (05/1978).

Availability: AD-A056 364/35T
NTIS

An analysis is presented of charged transmission-line
configurations for use in high-current accelerators. Basic drawbacks
of the symmetric radial-pulse line design are identified. The concept
of using asymmetric pairs of transmission lines of various geometries
is introduced. Conditions for maximum efficiency and maximum energy
transfer to the beam load are derived for ideal constant-impedance
lines. It is shown that in the lossless limit approximation,
asymmetric line-based configurations exist with both high
accelerating voltage per stage and nominal unit efficiency can be
achieved. A recirculating accelerator is described, in which
advantage is taken of a repetitive voltage waveform present in the
transmission-line cavities to repeatedly accelerate a current pulse
which is recirculated through the accelerator. Expressions for the
open-circuit output voltage, accelerating voltage per stage, and
efficiency of energy transfer to the beam are derived for this case
also. It is shown that, with proper choice of parameters, this type
of design again affords the possibility of nominal unit efficiency
for energy transfer to the beam. (Author)

Primary Keywords: Electric Accelerators; Transmission Lines; Electron
Beam Pulses; Energy Transfer; High Power; Voltage;
Efficiency; Recirculation; Physics Laboratories;

Army Research Laboratories; NTISDODXA

5162

(PULSE GENERATORS)
(Capacitive)

BIG OPTICAL SPARK CHAMBERS AND PULSE GENERATORS FOR THEIR SUPPLYING

A.F. Grushin, A.I. Egorov, L.K. Lytkin, A.F. Pisarev and V.F. Pisarev
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).

Availability: JINR-R-13-9745
NTIS

The construction is described and main operating characteristics
are presented for big optical spark chambers with the gas of 2 cm,
used in particle beams from accelerators. The working substance on
the path of particles in the chambers is small and the chambers are
of high shower efficiency. The characteristics of high-voltage pulse
generators, feeding these chambers, are presented. (Atomindex
cit. on C9-358364)

Primary Keywords: High-voltage Pulse Generators; Spark Chambers;
Aluminum; Design; Diagrams; Efficiency; Electrodes;

Fabrication; Foils; Spark Gaps; Specifications;

Secondary Keywords: ERDA/440104; NTISINIS Microfiche Unit

Distribution Restriction: U.S. SALES ONLY.

5164
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

CALIBRATION OF HIGH-VOLTAGE PULSE MEASUREMENT SYSTEMS BASED ON THE KERR EFFECT

R.E.J.M. Heber
Sandia Labs, Albuquerque, NM 87115
Final rept. Jul 75-Oct 77 No. NBSIR-77-1317, 39p (89/1977).
Availability: PB-274 333/45T

NTIS

High voltage pulse measurements have been performed using systems based on the electrooptical Kerr effect for a number of years. These systems permit state-of-the-art measurements (uncertainties approximately equal to + or - 1%). Because the precision of the measurement can be significantly better than the accuracy, an investigation of techniques to improve the calibration of the system was undertaken. The investigation focused on two areas. One was the experimental determination of correction factors which would account for differences in environmental factors between the calibration of the system and its use. These measurements yielded accurate corrections for variations in temperature and quantitative evidence of the magnitude of the wavelength dependence of a Kerr system's response. The second was further study into the feasibility of calibrating the Kerr system at a number of discrete frequencies and using this calibration for pulse measurement.

Primary Keywords: Kerr Cells; Electrical Measurement; Pulse; High Voltage; Calibrating; Kerr Electrooptical Effect; Nitrobenzene; Space Charge

Secondary Keywords: NTISCOMBNS

5167
(BREAKDOWN STUDIES)
(Exploding Wires)

POSTULATION OF THE ARC RESTRIKE MECHANISMS FOR EXPLODING WIRES AND TUBES

D.Y. Chen, W.J. Loubsky and V.E. Fousekis
University of Santa Clara, Santa Clara, CA 95053

The Physics of Fluids, Vol. 14, No. 11, pp 2328-2336 (11/1971).

Many facets of exploding wire restrikes are studied. They are related to the cylindrical shock wave which pumps down the density of the center region of a line energy source or around the surface of the heated wire continuously to 1.5 times the initial density. If the density of any region is pumped down to lower than Paschen's electric breakdown criteria, restrike occurs. The cylindrical shocks occurring in exploding wires are, in general divided into two types. In the first type the shock is generated by wire explosion and in the second type the shock is generated by the heat conduction of the wire to the surrounding gas. Application of this mechanism to exploding tubes will enable us to create arc channels in arbitrary gaseous atmospheres with controllable plasma density with the contamination excluded. Neutral density shielded plasma experiments, therefore, can be conducted in a controllable environment. 14 Refs.

Primary Keywords: Exploding Wire; Exploding Tube; Arc Restrike;

Cylindrical Shock Wave

Secondary Keywords: Velocity; Density Calculation; Thermal Conduction

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

5170
(PARTICLE BEAMS, ION; PARTICLE BEAMS, NEUTRAL)

(Generation; Generation)

DESIGN PHILOSOPHY AND USE OF HIGH VOLTAGE POWER SYSTEMS FOR MULTI-MEGAMAX ION BEAM ACCELERATORS

G.C. Barber, A.Y. Broverman, R.E. Hill, C.M. Loring and N.S. Ponte
Oak Ridge National Lab., Oak Ridge, TN 37830

Availability: CONF-771829-68

NTIS

The requirements for a neutral beam high voltage power system are derived from the characteristics of the ion source. High voltage system component characteristic requirements and choices are described. (ERA citation 03:016278)

Primary Keywords: Neutral Beam Sources; Power Supplies; Beam Injection Heating; Design; Ion Sources; Plasma Heating; Recommendations; Specifications

Secondary Keywords: ERDA/700205; NTISDE

5177
HIGH-VOLTAGE TEST STAND AT LIVERMORE

M.E. Smith
Lawrence Livermore Lab., Livermore, CA 94550
No. CONF-771029-78, 7p (10/1977).

Availability: UCRL-79614

NTIS

This paper describes the present design and future capability of the high-voltage test stand for neutral-beam sources at Lawrence Livermore Laboratory. The stand's immediate use will be for testing the full-scale sources (120 kV, 65 A) for the Magnetic Fusion Test Reactor. It will then be used to test parts of the sustaining source system (80 kV, 85 A) being designed for the Magnetic Fusion Test Facility. Following that will be an intensive effort to develop beams of up to 200 kV at 28 A by accelerating negative ions. The design of the test stand features a 5-MVA power supply feeding a vacuum tetrode that is used as a switch and regulator. The 500-kW arc supply and the 180-kW filament supply for the neutral-beam source are battery powered, thus eliminating one or two costly isolation transformers. (ERA citation 03:016277)

Primary Keywords: Neutral Beam Sources; Test Facilities; Design; Electronic Circuits; Performance; Power Supplies; Test Device

Secondary Keywords: ERDA/700205; NTISDE

5179
(PARTICLE BEAMS, ELECTRON)

(Generation)

INVESTIGATION OF A HIGH VOLTAGE HOLLOW CATHODE ELECTRON BEAM SOURCE

J. Hansen
Risoe National Lab., Roskilde (Denmark).
(04/1977).

Availability: RISO-359

NTIS

An investigation is presented of the possibility of developing an electron accelerator comprising several radiation units with a relatively low power per unit, and without the many elements such as accelerator tube, focusing and scanning systems. A study was desired of an electron gun operated at 200 kV based on the cold, hollow-cathode principle, where problems concentrated on the design of an electrode configuration that could withstand the high voltage at a pressure where a plasma could be generated too. Studies concentrated on the high voltage breakdown criterion in the pressure range 10^{-3} to 10^{-2} torr and on the plasma formation in a low pressure gas discharge. Controlled beams with energies up to 130 keV were generated in nitrogen at a pressure of 2×10^{-3} torr with beam current of about 1 mA in a continuous operation. The high voltage was limited by the existing power supply in the laboratory; however, a decision was taken not to purchase a power supply that could have delivered the required voltage. (Atomindex citation 08:343720)

Primary Keywords: Electron Sources; Breakdown; Cold Cathode Tubes; Electric Potential; Electron Beams; Electron Guns; Feasibility Studies; Glow Discharges; Hollow Cathodes; Key Range 10-100; Medium Vacuum; Paschen Law; Plasma Instability

Secondary Keywords: ERDA/430100; Denmark; NTISIHIS

Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

5180
(BREAKDOWN STUDIES)

(Liquid, Electrical)

INVESTIGATIONS ON BREAKDOWN EVENTS IN LIQUID NITROGEN AT HIGH VOLTAGES

D. Peter
Technische Univ. Brunswick (West Germany). Fakultat fuer Maschinen und Elektrotechnik.
(06/1975).

Availability: NP-22472

NTIS

The breakdown of liquid nitrogen was investigated using dc, a impulse voltages up to 200 kV. The electrode arrangement varied point-to-plane electrodes with point radii of 40 μm to electrode. With nearly homogeneous fields. Electrode material and surface roughness were taken into account. The prebreakdown events were studied by the charge of the electrode, the breakdown itself by measuring the voltage across the electrodes, the current. Some types of instable discharges were detected, but unstable ones (streamer model) followed the breakdown occurred within 20 ns. The breakdown field strength depends on the gap distance s and the electrode radius. There is a minimum field strength due to the ratio of s/r = 5 to At a gap distance of 1 mm breakdown voltages of 50 kV were measured at ac and dc under atmospheric pressure (homogeneous field). This value is influenced by the surface roughness and the heat flux into LN sub 2. Electrode material is only of little influence. Based on these measurements some aspects of a breakdown mechanism are pointed out: electrons, generated by field emission, may cause microbubbling in front of microtips on the surface. The microbubbles may be the starting point for ionization processes and avalanches, leading to a breakdown channel. The channel build up is similar to the streamer and leader mechanism, observed in long air gaps. (ERA citation 03:008313)

Primary Keywords: Cryogenic Cables; Nitrogen; Breakdown; Cryogenic Fluids; Data; Dielectric Materials; EHV Ac Systems; EHV Dc Systems; Performance Testing

Secondary Keywords: ERDA/280303; ERDA/420201; West Germany; Dielectric Breakdown; Liquid Nitrogen; High Voltage; NTISDE

Distribution Restriction: U.S. Sales Only.

5181
(PULSE GENERATORS)

(Trigger)

LIMITING CONDITIONS IN A FERREORESONANT TRIGGER CIRCUIT

J.G. SKALNIK
Yale Univ New Haven Conn Dunham Lab
(10/1955).

Availability: AD-079 851/251

NTIS

No abstract available.

Primary Keywords: Trigger Circuits; Circuits; Mathematical Analysis

Secondary Keywords: NTISDDDX

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO

MICROFICHE.

5184

OPTICALLY COUPLED HIGH VOLTAGE ISOLATION AMPLIFIER

J.W. Pearce
Oak Ridge National Lab., Oak Ridge, TN 37830
(02/1978).

Availability: ORNL/TM-6207

NTIS

A common and persistent problem in modern instrumentation is the observation and recording of small signal waveforms that are removed from ground by very high voltages. Examples of this are the instrumentation of neutral particle injectors used in controlled thermonuclear research and the construction of safety breaks for air core toroidal devices. To overcome this problem a very high voltage isolation amplifier was designed. It employs analog-to-digital conversion of the serial data transmission on a fiber optic cable. (ERA citation 03:03247)

Primary Keywords: Measuring Instruments; Neutral Beam Sources; Amplifiers; Analog-to-digital Converters;

Construction; Design; Neutral Atom Beam Injection;

Thermonuclear Reactors

Secondary Keywords: ERDA/700209; ERDA/700205; Isolation; High Voltage; Fiber Optics Transmission Lines; NTISDE

5185

(POWER CONDITIONING)

(Saturation Reactors)

POSSIBILITY OF USING MAGNETIC PULSE GENERATORS IN LINEAR INDUCTION

ACCELERATORS

R.V. Khar'yuzov and V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).Availability: JINR-9-9523
NTIS

Results of an experimental study of pulse magnetic generators for the LIU-30 pulsed linear accelerator are given. The pulse magnetic generator is essentially a forming line including capacitors and iron-core chokes. Two types of generators are described: generators of the first type are energized from an ac source and have no controlled switches, while those of the second type are energized from a dc source and contain controlled switches. Advantages of generators of the second type are shown. Circuits of generators of the second type for 18 and 24 kV are given. Experiments aimed at producing a nanosecond front in generator pulses indicate that in the case of high-quality permalloy or permendur being used as the material of the choke cores, a pulse with a front of 50 to 60 ns at an amplitude of up to 100 A can be obtained. To provide the front of less than 10 ns, the use of two-stage stages should be made of low-inductance capacitors with an intrinsic inductance of no more than a few nH. The results of the study show that pulse magnetic generators operate stably with a load of 500 to 1,000 Ohm. At this load the current front is 5 to 6 ns. (Atomindex citation 09-363273)

Primary Keywords: Accelerators; High-voltage Pulse Generators;
Capacitors; Diagnoses; Electric Coils; Frequency
Dependence; Induction; Performance; Permalloy; Pulse
Rise Time; Pulse Shapers; Reliability;
Specifications; Thyristors

Secondary Keywords: ERDA/430303; USSR; NTISINIS

Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES
ONLY.

5186

(PARTICLE BEAMS, NEUTRAL)

(Generation)

PRESENT AND FUTURE TECHNOLOGY OF HIGH VOLTAGE SYSTEMS FOR NEUTRAL BEAM

INJECTIONS

H.R. Baker and D.B. Hopkins
Lawrence Berkeley Lab, Berkeley CA
No. CONF-771213-8, 36p (01/1978).Availability: LBL-7261
NTIS

This paper presents: (1) A brief review of existing neutral beam (NB) power supply technology for operating up to approximately 200 kV, 65 A; (2) Possibilities for using existing systems for next-generation NB sources, and associated problems; (3) A summary of the features of present systems which contribute to a high degree of complexity and/or cost; (4) A plea and proposal for minimizing cost and complexity of future systems operating up to approximately 300 kV; (5) A few comments pertaining to special problems associated with operating in the 300 to 1000-kV range; and (6) A listing of some specific tasks areas which believe should receive early R and D effort. (ERA citation 03-032413)

Primary Keywords: Neutral Beam Sources; Power Supplies; Cost; Research
Programs; Reviews; Thermonuclear Reactors

Secondary Keywords: ERDA/700203; ERDA/700205; Neutral Atomic Beam
Injection; NTISDE

5189

(ENERGY CONVERSION, MECHANICAL)

(Charging Circuits)

PULSE CHARGING OF NANOFARAD CAPACITORS TO TEENS OF KILOVOLTS FROM THE

SHOCK DEPOLING OF PZT FERROELECTRIC CERAMICS

M.J.H.M. Moel
Naval Surface Weapons Center, Dahlgren, VA 22448
Final rept. No. NSWC/DL-TR-7804, 74p (04/1978).Availability: AD-A058 607/35T
NTIS

Gas gun impact techniques have been used to pulse charge nanofarad capacitors from the shock depoling of PZT 56/44 and PZT 95/5 ferroelectric ceramics. The PZT materials were depoled in the normal mode. Pulse powers of hundreds of kilowatts were produced in a few microseconds. The PZT 56/44 material was impacted in the stress range from 4.4 to 11.8 GPa. A maximum load voltage of 55 kV was produced at 7.9 GPa. Shock-induced electrical breakdown in the PZT material occurred at 11.8 GPa. The PZT 95/5 material was impacted at 1.4 and 2.9 GPa stress levels. A maximum load voltage of 81 kV was produced at the higher stress. (Author)

Primary Keywords: Pulse Generators; Shock Waves; Ferroelectric
Crystals; Breakdown(Electronic Threshold);
Dielectric Properties; High Energy; High Voltage

Secondary Keywords: Capacitor Chargers; NTISDDXA

5190

(PULSE GENERATORS)

(Capacitor Banks)

PULSE MODULATOR FOR AN EXPERIMENTAL ELECTRON GUN

P.S. Antsyupov, I.M. Metra and V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1975).Availability: JINR-13-9277
NTIS

The construction features are described and the main diagram is presented for a pulse modulator with an output power up to 150 kW, potential of 60 kV, and pulse current of 2500 A. A capacitive energy accumulator with particle discharge and output pulse transformer are used in the modulator. An advantage of the modulator is the absence of high-energy forming lines. The modulator consists of three main units: the accelerating structure device, a Faraday sub-modulator, and a modulator with anode tubes. There is also a series of charging devices, a water-cooling system, and a system of locking, control, and a gaseous units. The main feature of the modulator is the absence of a constant potential on the screening grids of the modulator tubes; the modulator tubes are started up simultaneously through two grids—the control and the screen. The tubes are cooled by water forced from the water-distillation unit with 4.5 atm pressure. The modulator has operated dependably for 4 years and has shown highly constant parameters for the output pulse and reliability in operation. (Atomindex citation 09-360709)

Primary Keywords: Electron Guns; Control Systems; Cooling; Diagrams;
Induced Pressure; Modulation; Pulse Shapers; Pulses;
Thyristors; Thyristors; Transformers; Trigger
Circuits

Secondary Keywords: ERDA/430200; USSR; NTISINTS

Distribution Restriction: U.S. SALES ONLY

5191

(POWER CONDITIONING)

(Pulse Transformers)

PULSE TRANSFORMER DESIGN STUDY

H Aslin
Physic International Co., San Leandro, CA 94577
Final rept. Dec 75-Mar 77 Mo. PIFR-B97, 79p (11/1977).Availability: AD-A047 499/95T
NTIS

This final report describes the design, development of fabrication techniques, fabrication, and testing of two uniform field, air core pulse transformers. The described transformer design minimizes the volume of dielectric material, which provides turn-to-turn insulation, reduces stray series inductance, and thus improves the transformer high frequency response in comparison to conventional pulse transformers. The described pulse transformers are intended for repetitive pulse operation with output voltages of about 200 kV into matched resistive loads. Output pulse width and risetimes are about 10 microseconds and 1 microsecond (10 to 90 percent) respectively. (Author)

Primary Keywords: Pulse Transformers; Solenoids; Electric Coils;
Fabrication; Inductance; Frequency Response;
Dielectrics; Pulse Trains; Electric Fields;
Insulation; Lightweight

Secondary Keywords: Air Cores; Dielectric Constant; NTISDDXA

5192

(PARTICLE BEAMS, ELECTRON)

(Generation)

REB FOCUSING IN A HIGH-VOLTAGE DIODE

I.P. Afonin, M.V. Babkin and B.V. Beav
GKAE Atomic Energy Institute, Moscow, USSR
(02/1978).Availability: SAND-78-6005
NTIS

Experimental data on the focusing of an intense relativistic electron beam on the "Angara-11" and "Kalmars-11" accelerators are reported. The use of these accelerators to simulate conditions in a controlled thermonuclear reactor with inertial plasma confinement is discussed. (ERA citation 03-033593)

Primary Keywords: Accelerators; Thermonuclear Reactors; Electron
Beams; Focusing; Foils; Heating; Plasma Confinement;
Relativistic Range

Secondary Keywords: ERDA/430200; ERDA/700208; Translations; USSR;
NTISDET

Distribution Restriction: TRANSLATION BY P. NEIMAN OF ISSLEDOVANIE
FOKUSIROVKA REB V VYSOKOVOL'NOH DIODE.

5193

REPETITIVE SERIES INTERRUPTER II

R.F. Caristi, R.P. Simon and D.V. Turnquist
EG&G Inc, Salem, MA 01970

Interim rept. no. 7, 1 Oct 77-31 Jan 78 (06/1978).

Availability: AD-A055 999/75T
NTIS

The interruption characteristics have been established for six developmental "plasma chute" interrupters, five rated at 15 kV and one rated at 30 kV. Six-hundred ampere interruptions at 20 kV have been achieved with a magnetic field energy of less than 6 Joules. The most significant improvement in the interrupter design has been made in one which contains both a "chuted" surface against which the discharge is magnetically driven, and an unchuted (smooth) surface located behind the driven discharge, the presence of which latter surface minimizes the availability of plasma to sustain the discharge. Typical interaction column drops have been found to be 300 to 400 volts per section (20 to 26 volts/cm) at reasonable tube pressures with no more than three (and possibly two) sections being adequate for the operation of tubes rated at 50 kV. Holdoff-section voltage drops of about 120 volts have been observed for holdoff sections capable of withstanding 30 kV. A total tube drop of 830 volts has been observed at the 25 kV, 18.5 A level. Linear extrapolation of existing data to the 30 kV, 1000 A level shows that reliable interruption should be achievable with a magnetic field energy of the order of 10 Joules for an interrupter having a total tube drop of about 1200 volts, or 2.4X of the system's operating voltage. (Author)

Primary Keywords: Interrupters; Thyatrons; Switching Circuits;
Plasmas(Physical); Magnetic Fields; Gas Discharges;

Trigger Circuits; Electric Discharges; Protective
Equipment; Energy; Pulse Generators

Secondary Keywords: Hydrogen Thyatrons; NTISDDXA

5195

(BREAKDOWN STUDIES)

(Gas, E-beam)

SMALL SCALE DISCHARGE STUDIES

M. Ronkin, J.H. Jacob and J.A. Mengano
Avco Everett Research Lab, Inc, Everett, MA 02149

Semiannual rept. 1 Sep 76-28 Feb 77 (02/1977).

Availability: AD-A047 221/5T
NTIS

The dominant formation and quenching processes in e-beam pumped ArFx and KrFx lasers are discussed. The exciplexes are produced by irradiating Ar/F2 and Ar/Kr/F2 mixtures with a 5 eV/cm2, 150 keV e-beam. A steady state analysis is valid since the recombination times are short compared to the 300 nsec beam pulse length. The quenching of ArFx by F2 and Ar has been measured by analyzing the ArFx fluorescence as a function of the F2 and Ar partial pressures. We have also measured the displacement of the Ar in ArFx by Kr to form KrFx. The dominant quenching processes of KrFx were identified and the rate constants were measured. The ArFx and KrFx are formed from the ionic states with high efficiency. Interception of the precursors can be made negligible by choosing the experimental conditions properly. The quenching of KrFx by Ar and Kr is mainly a three body process resulting in the formation of KrF2+. The emission from KrF2+ was observed in a broad band centered at 410 nm. We have verified that the Kr2Fx is produced subsequently to the KrFx formation by performing a laser saturation experiment.

Primary Keywords: Ultraviolet Lasers; Gas Lasers; Rare Gases;
Fluorides; Argon Lasers; Electron Beams; Krypton;
Gas Discharges; High Voltages; Fluorescence; Quenching

Secondary Keywords: Krypton Fluoride Lasers; Argon Fluoride Lasers;
Electrical Lasers; Reaction Kinetics; NTISDDXA

/61

5196
(SWITCHES; CLOSING)
(Gas Gap; Materials)

SPARK GAP OVERPRESSURES IN THE TRANSFER CAPACITOR DEVICE
L.C. Burkhardt and R.S. Dike
Los Alamos National Laboratory, Los Alamos, NM 87545
No. CONF-771029-29, 4p (01/1977).
Availability: LA-UR-77-2417
NTIS

A designer of spark gaps is often faced with two gas pressure problems, one static and one dynamic. The former is easy to obtain data on which to base intelligent design specifications; about the latter, less is known. It is the total internal pressure environment we have attempted to measure, in an un-time-resolved way, in order to give the designer some rationale in designing gaps of this category. We measure overpressures of approximately 400 PSI in a 13 cubic inch gap passing currents of approximately 200 KA. (ERA citation 03:020701)

Primary Keywords: Power Supplies; Spark Gaps; Breakdown; Capacitors; Electrodes; Fields; Medium Pressure; Switches; Thermonuclear Devices

Secondary Keywords: ERDA/700203; NTISDE

5197
(POWER CONDITIONING; PULSE GENERATORS)

(Pulse Transformers; Blumlein Lines)
STREAMER CHAMBER POWER SUPPLY ON THE BASE OF A 500KV PULSE TRANSFORMER
Y.V. Grishkevich, D. Poze, K. Ryuger, K. Tryuchler and G. Peter
Joint Inst. for Nuclear Research, Dubna (USSR).
Availability: JINR-R-13-9306
NTIS

Theory and constructional layout of a pulse transformer is given by which it is possible to drive a large Blumlein-line as a high-voltage pulse generator for a streamer chamber. The transformer is capable of generating voltage pulses with an amplitude of 500 KV at a load of 1000 pF. The rise time of the pulse is 300 nsec. The stability of the pulse amplitude in the streamer chamber is $\pm 1.5\%$ and the jitter of the pulse delay time is ± 10 nsec. (Atomindex citation 08:318990)

Primary Keywords: High-voltage Pulse Generators; Streamer Spark Chambers; Diagrams; Pressure Dependence; Pulse Shapes; Specifications; Surges; Transformers

Secondary Keywords: ERDA/440104; USSR; NTISINIS

Distribution Restriction: Available in microfiche only. U.S. Sales Only.

5198

SUPER POWER GENERATORS

T.H. Martin, D.L. Johnson and D.H. McDaniel
Sandia Labs., Albuquerque, NM 87115
No. CONF-771035-5, 24p (01/1977).

Availability: SAND-77-1324c
NTIS

PROTO III, a super power generator, is presently undergoing testing at Sandia Laboratories. It has operated with an 80 ns, 30 ns, 35 ns, and 20 ns positive output pulse voltage and achieved total current rates of rise of 4-10 A/ns. The two-sided E-beam accelerator concept, using two diodes has achieved voltages of 1.5 MV and currents of 4.5 MA providing a power exceeding 6 TW in the electron beam and 8 TW in the transmission lines. A new test bed named MITE (Magnetically Insulated Transmission Experiment) was designed and is now being tested. The pulse forming lines are back to back short pulse Blumlein lines which use untriggered water switching. Output data showing a ten ns half width power pulse peaking above one terawatt were obtained. MITE is a module being investigated for use in the Electron Beam Fusion Accelerator and will be used to test the effects of short pulses propagating down vacuum transmission lines. (ERA citation 03:008968)

Primary Keywords: Generators; Power Transmission Lines; Design; Electron Beams; High-voltage Pulse Generators; Magnetic Shielding; Mega Ampere Currents; Operation; Performance Testing; Thermonuclear Reactors

Secondary Keywords: ERDA/430300; ERDA/700208; NTISDE

5200
(POWER CONDITIONING)
(Pulse Transformers)

THE THEORY OF THE OPTIMUM TRANSMISSION-LINE PULSE-TRANSFORMER
F.J. YOUNG
Carnegie Mellon University, Pittsburgh PA 15213
(10/1956).

Availability: AD-114 090/457
NTIS

No abstract available.

Primary Keywords: Transmission Lines; Transients; Determination; Theory
Secondary Keywords: Pulse Transformers; NTISDOODX
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE:
ONLY 35MM MICROFILM IS AVAILABLE. NO
MICROFICHE.

5201
(PULSE GENERATORS)

(Systems)

TRIGGER AND CONTROL CIRCUITS FOR HIGH-VOLTAGE GENERATORS

K. Ondrejkova and L.K. Lytkin
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear
Problems.
(01/1977).

Availability: JINR-R-13-10432
NTIS

Fast trigger and control circuits have been designed for a system of high-voltage generators used for spark chamber supply. The trigger circuit has been constructed on the basis of the tube GI-30 and semiconductor transistors KT603B operating in a shower regime. The control circuit has been constructed of integrated circuits of TTL type. For a long time the scheme was tested on the magnet spark spectrometer of the IINR and was found to be highly reliable. (Atomindex citation 08:33362)

Primary Keywords: High-voltage Pulse Generators; Spark Chambers;
Control Systems; Diagrams; Integrated Circuits;

Logic Circuits; Transistor Trigger Circuits
Secondary Keywords: ERDA/440104; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY U.S. SALES
ONLY

5203
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

USE OF A CORONA IN THE NEEDLE-PLANE SYSTEM AS A HIGH-VOLTAGE DIVIDER
ELEMENT

L.V. Smirnov, V.D. Mikhailov and R.S. Chechikov
OKAE Atomic Energy Institute, Moscow, USSR
(01/1975).

Availability: NIIIEFA-D-0246
NTIS

Some characteristics are investigated of a corona discharge in a needle-surface system with a view to utilizing corona-discharging gaps as elements of a high-voltage divider. Results are cited for preliminary trials of a "corona divider" model. A comparative assessment is also given with regard to divider efficiency.

Primary Keywords: Electrostatic Accelerators; Breakdown; Comparative Evaluations; Corona Discharges; Efficiency; Electric Potential; Medium Pressure; Nitrogen; Pressure Dependence

Secondary Keywords: ERDA/430200; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

5204
(PARTICLE BEAMS, ELECTRON; SWITCHES; CLOSING; ENERGY STORAGE,
CAPACITIVE)

(Reviews; Reviews; Marx Generators)

LASER-FUSION AND ELECTRON-REA-M-FUSION PROGRESS REPORT JULY-DECEMBER 1974
Sandia Labs., Albuquerque, NM 87115
Sandia Report No. SAND75-0262 (06/1975).

Availability: SAND75-0262
NTIS

This report provides an overview of the research conducted at Sandia Laboratories in July-December 1974. The laser fusion program is discussed with most attention placed on lasing action in the laser medium and target interaction. The report on electron beam fusion is characterized by sections on energy storage, switching, transmission lines, and diode construction. Theoretical work on target design and plans for the future are included. 11 Refs.

Primary Keywords: E-beam; Water Switch; Oil Switch; Gas Gap; Blumlein; Magnetic Insulation; Water Insulated Transmission Line

Secondary Keywords: HF Laser; KrO Laser; Laser-target Interaction

5205
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Explosive Fuses; Miscellaneous)

MICROWAVE DOPPLER MEASUREMENTS OF THE IONIZATION FRONT IN CYLINDRICAL SHOCK WAVES FROM EXPLODING WIRES

D.L. Jones and M. Gelleot

National Bureau of Standards, Boulder, CO 80302
Exploding Wires, Vol. 1, pp 127-141 (01/1962).

Strong cylindrical shock waves from exploding wires have been measured by microwave Doppler techniques. The results obtained simultaneously on two or three independent frequencies are in very good agreement and show that the ionization front is well defined. The Taylor-Lin similarity blast wave theory for the shock wave propagation is well verified over distances up to 6 or 7 cm under the present conditions. Systematic results for the determination of shock wave energy and the efficiency for shock production in air over a range of pressures, wire diameters, and stored electrical energy are presented. Relative to optical methods used in the same problem the present technique is more sensitive and perhaps more precise. It is remarkable that very good reflections are still consistently obtained when the shock Mach number falls below 3 in air. From the calculated temperature of ionization near the shock front, the expected reflection density would be negligible. This effect is probably a result of the pre-excitation of the gas ahead of the shock front, caused by ultraviolet radiation from the wire explosion or from the advancing shock front itself. There is also a relatively weak precursor, for which recent microwave absorption measurements have indicated electron densities of the order of 1E11/cm. Several cm. ahead of the front. The good reflection at low Mach numbers permits one to show that the similarity theory is still valid until Mach number 4 or below. 9 Refs.

Primary Keywords: Exploding Wires; Shock Wave; Low Mach Numbers; Comparison With Optical Technique; Pre-excitation; Precursor Ionization

COPYRIGHT: 1962 PLenum Press

5206
(SWITCHES, OPENING)
(Explosive Fuses)

PRECURSOR ELECTRONS AHEAD OF CYLINDRICAL SHOCK WAVES

D.L. Jones

National Bureau of Standards, Boulder, CO 80302
The Physics Of Fluids, Vol. 5, No. 9 pp 1121-1122 (09/1962).

Microwave absorption techniques are used to study the ionization ahead of cylindrical shock waves produced by exploding wires. Before the front of the shock wave reaches the microwave beam, significant ionization occurs in the area. Possible explanations are discussed. The tests were done using a copper wire in air, argon, nitrogen, and helium. 8 Refs.

Primary Keywords: Exploding Wires; Plasma Radiation; Cylindrical Shock Wave; Gas Pressure

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

5207
(SWITCHES, CLOSING)

(Gas Gap; Optic)

LASER TRIGGERED SPARK GAP USING FIBER OPTIC TRANSMISSION

H.C. Marjes

Texas Tech University, Lubbock, TX 79409

LLL Report No. UCRL 15202 (12/1979).

Availability: UCRL 15202
NTIS

The use of an optical fiber in a laser triggering system is described. The fiber transmits a high power ruby laser pulse which triggers a high voltage spark gap. The spark gap is a gas switch on a water dielectric Blumlein generator which is pulse charged by a three stage Marx bank. Typical operating parameters for the spark gap are: 2 cm gap, 2700 Torr pressure, Ar-N₂ 2/1 gas mixture, and a charging voltage of 200 KV. The single strand, 1 mm, quartz, optical fiber is spliced to a fiber optic switch which has a switching capacity of 10¹⁰ pulses of 4 MW are coupled into and transmitted by the fiber with no observed damage. The overall optical system transmission efficiency is 62%. The triggering performance of the system is excellent in that switching delays of less than 10 ns and subnanosecond jitters are measured. 11 Refs.

Primary Keywords: Laser Triggering; Fiber Optic; Ruby Laser; Low Jitter

102

5208
(PARTICLE BEAMS)
(Reviews)

DEVELOPMENTS IN SANDIA LABORATORIES PARTICLE BEAM FUSION PROGRAM
G. Yonas and The Sandia Laboratories Particle Beam Fusion Group
Sandia Labs, Albuquerque, NM 87115
Seventh International Conference On Plasma Physics And Controlled
Nuclear Fusion Research (08/1978).

An overview of work being done by the Sandia Labs particle beam fusion group is presented. Developments in the areas of light ion drivers and targets specifically tailored for that type of beam are described. Overall requirements for the reactor itself are examined.

21 Refs.

Primary Keywords: High Energy; High Current; High Power

Secondary Keywords: Fusion Reactor; Fusion Targets

COPYRIGHT: ????????????

5233
(BREAKDOWN STUDIES)
(Partial Discharges)

AN INFORMATIVE METHOD FOR RECORDING PARTIAL DISCHARGES IN INSULATING MATERIALS

R.G. Johnson and S.J. Tibbets
Honeywell Corporate Research Center, Bloomington, MN 55420
The Review of Scientific Instruments, Vol. 44, No. 4, pp 519-520
(04/1973).

A method of recording large numbers of partial discharge pulses graphically as a function of specimen voltage on a linear time base is described. The conventional method, using a Lissajous figure synchronized with the specimen voltage, does not show a graphic relation between the pulse occurrence and specimen voltage, and is limited by the repetitive nature of the Lissajous figure. Examples of the discharge pulse patterns obtained with the new method are given to illustrate the versatility of the technique. The method provides useful information in the study of partial discharge characteristics and causes. 1 Refs.

Primary Keywords: Partial Discharge; Several Discharges; Automated System; Specimen Voltage Recording

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5236
(INSULATION, MATERIAL)
(Gas)

COMPRESSED GAS INSULATION IN THE MILLION-VOLT RANGE: A COMPARISON OF SF₆/SUB 6/ WITH N₂/SUB 2/ AND CO₂/SUB 2/

S.F. Philip
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-82, No. 3,
pp 356-359 (06/1963).

The maximum voltage which can be insulated between a sphere and a plane has been measured as a function of gas pressure and gap. It is found to be approximately three times higher in SF₆/SUB 6/ than in N₂/SUB 2/ + CO₂/SUB 2/, up to pressures of roughly 9 atm. For higher pressures the relative superiority of SF₆/SUB 6/ over N₂/SUB 2/ + CO₂/SUB 2/ diminishes. Gradients of more than 100 MV/m were insulated on a 19-mm-diameter electrode in 20 atm of SF₆/SUB 6/. 26 Refs.

Primary Keywords: Sphere-plane Gap; Several Gases; Variable Gas Pressure; Variable Gap Spacing

COPYRIGHT: 1963 IEEE, REPRINTED WITH PERMISSION

5249
(INSULATION, MATERIAL)
(Gas)

FLUOROCARBON GASES

J.T. Milak
Hughes Aircraft Co., Culver City, CA 90238
Data sheets No. ds-142, 2p (11/1964).
Availability: AD-608 897

A compilation of the electrical properties of various halocarbon or halogenated hydrocarbons known as Freons, Genetrons, Arctons, etc., is presented. A master identification chart relating the trademarks and numbers to the chemical name is included for easy reference. Detailed electrical properties include Corona effects, dielectric constant, dielectric strength and dissipation factor. Each property is compiled over the widest possible range of pressure, temperature, electrode geometry effects and types of electrodes from references obtained through literature search. Physical and chemical property data are also included as well as electrical and electronic applications. (Author)

Primary Keywords: HALOGENATED HYDROCARBONS; ELECTRICAL PROPERTIES; FLUORINE COMPOUNDS; ELECTRICAL PROPERTIES; ELECTRICAL PROPERTIES; HALOGENATED HYDROCARBONS; GASES; DIELECTRICS; FLUOROCHLORIDES; BROMINE COMPOUNDS; FLUORIDES; ALIPHATIC COMPOUNDS; ELECTRICAL CORONA; DATA

Secondary Keywords: FLUOROCARBONS

5255
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

INVESTIGATION OF A LASER TRIGGERED SPARK GAP
W.K. Pendleton (1) and A.H. Guenther (2)
(1) AFIT, Wright-Patterson AFB, OH
(2) AFML, Kirtland AFB, NM 87117
The Review of Scientific Instruments, Vol. 36, No. 11, pp 1546-1550
(11/1965).

The influence of parameters affecting the laser triggering of a high voltage electrical sphere-sphere gap has been experimentally investigated. Of primary interest was the delay time between arrival of the laser pulse and current flow across the gap. This delay was studied as a function of total laser beam power (0-80 MW); dielectric gas (SF₆/SUB 6/, N₂/SUB 2/, air); gas pressure (100-1400 Torr); electrode spacing (0.4-1.5 cm); gap electric field (10-100 kV/cm); and focus point location between two 5 cm dia. stainless steel spheres. Delay times less than 10 nsec were observed in SF₆/SUB 6/ at atmospheric pressure with corresponding low jitter. For the cases studied, delay time varied inversely with the electric field, gas pressure, and focus point distance from the anode surface. Above a certain laser beam power the delay time was not a significant function of laser power for the range studied. Applications of laser triggering are discussed with a description of current and future research areas. 12 Refs.

Primary Keywords: Delay Measurements; Sphere-sphere Gap; Several Gases; Variable Pressure; Variable Spacing; Variable Voltage

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5260

NANOSECOND SWITCH DEVELOPMENT

J.M. Proud and P. Falenthal
Space Sciences Inc., Waltham, MA
Technical rept. 1 Jun 68-1 Apr 69 No. 551-229-FR, 156p (11/1965).
Availability: NTIS 653/357

NTIS

A program to develop a switch or switch technique suitable for use in a stripline voltage multiplication circuit is reported. Switch requirements include rise time and jitter of less than 5 nsec, inductance in the low nanohenry range, as well as simplicity, reliability and ease of maintenance. Two major tasks were the design and development of a high pressure gas switch aimed at meeting the above requirements and the obtaining of sufficient fundamental breakdown data in liquid and solid dielectrics to show their feasibility as a nanosecond switching medium. A comprehensive switch literature search and the bibliography included here show that no existing switches meet program requirements. (Author)

Primary Keywords: Pulse Switches; Electronic Switches; Dielectric Film; Dielectric Solids; Liquids; Pulse Generators; Gas Discharges; Electric Discharges; Reliability(Electronics); Abstracts; Halogenated Hydrocarbons; Halocarbon Plastics; Hydrocarbons

Secondary Keywords: Nanosecond Switch; Stripline Circuits; NTISDCDX

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5277

(SWITCHES, CLOSING; SWITCHES, CLOSING)

(Gas Gaps, Electrical; Liquid Gaps, Electrical)

THE ADVANCED DEVELOPMENT OF WATER TRIGATRON AND THREE-ELECTRODE SULFUR HEXAFLUORIDE SWITCHES

T. Fleischman and I. Smith
Physic International Co., San Leandro, CA 94577
Physics International Report No. PIFR-114 (01/1970).
Availability: AD-707407

NTIS

In this report, the performances of a water trigatron and a field distortion gas gap are compared. Voltage of interest ranged from 300 kV to 1 MV with jitters of 1 ns or less desirable. The gas switch is an SF₆/SUB 6/ filled spark gap with both a knife edge and fine wire used as trigger. Since the switch was designed to operate in a water filled line, the water trigatron was at first thought to provide the most promise, but subsequent tests proved that the gas switch had much less delay and jitter. The design philosophy is analyzed for each switch with several design tips presented. 0 Refs.

Primary Keywords: Water Trigatron; SF₆/SUB 6/ Field Distortion Gap; Performance Tests; Design Considerations; Transmission Line

5294

(BREAKDOWN STUDIES)

(Gas, Optical)

IONIZATION EFFECTS IN A HYDRODYNAMIC MODEL OF RADIATION-DRIVEN BREAKDOWN WAVE PROPAGATION

M.H. Key
Queen's University of Belfast
Journal of Physics B: Atom. Molec. Phys., Ser. 2, Vol. 2, pp 544-550
(05/1969).

An extension of the hydrodynamic theory of radiation-driven breakdown wave propagation is described in which ionization is treated explicitly in the conservation equations. A cubic equation relating the instantaneous velocity to the absorbed laser flux density is obtained. This reduces to the result obtained by Ramden and Savic in 1965 and Reizer in 1965 if ionization energies are neglected. Calculated results from the present theory are compared with those obtained by neglecting ionization. For the regime of interest in laser-induced breakdown of gases, the effects of ionization are seen to be significant. 10 Refs.

Primary Keywords: Laser Driven Breakdown; Breakdown Wave; Theory; Hydrodynamic Theory; Conservation Equation; Breakdown Wave vs. Laser Flux Relationship

COPYRIGHT: 1969 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5295

(PULSE GENERATORS; SWITCHES, CLOSING)

(Line Type; Gas Gaps, Electrical)

MULTIMEGAVOLT MODULATOR STUDY

J.J. Moriarty, H.I. Milde and J.E. Hippel
Ion Physics Corp., Burlington, MA 01803

Final technical rept. 6 Mar 69-4 Mar 70 (06/1970).
Availability: AD-873 259/657

NTIS

Energy storage and switching systems related to modulator operation at voltages in excess of one million volts are discussed. Two basic switching system types are treated in detail: the trigatron and the laser-triggered switch. Experimental determinations of multimegavolt switching range and spark gap erosion are described. Test results are presented for a high voltage pulse generator which can be controlled from ground potential by means of optical telemetry. A 1-M prototype of a high average power, high voltage power supply developed at the High Voltage Engineering Corporation is described. (Author)

Primary Keywords: Modulators; Pulse Generators; Electronic Switches; Trigger Circuits; Lasers; Radar Equipment; Voltage; Power Supplies

Secondary Keywords: NTISDDDX

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5297

(BREAKDOWN STUDIES)

(Gas, Electrical)

PHOTOGRAPHIC AND OSCILLOGRAPHIC INVESTIGATIONS OF SPARK DISCHARGES IN HYDROGEN

A.A. Doran and J. Meyer
University of New England, Armidale, NSW, Australia
British Journal of Applied Physics, Vol. 18, pp 793-799 (06/1967).

The development of spark discharges in near-uniform fields under low over-voltage has been studied with nanosecond resolution using image converter and intensifier techniques. The results indicate three main phases in the development of the discharge from the time of initiation by the Townsend mechanism up to the stage where complete voltage collapse across the gap is achieved. First, a quasi-stable glow-like discharge is built up, then thin filament progresses from the anode to the cathode-fall region. Finally, a luminous region moves quickly from anode to cathode, leaving behind the highly conducting spark channel. 5 Refs.

Primary Keywords: Hydrogen Breakdown; Near-uniform Field; Small Overvoltage; Third Breakdown Phases; Glow Region; Filamentary Spark Channel

COPYRIGHT: 1967 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5318

PICOSECOND RISETIME SWITCH STUDY

J.M. Proud and H.J. Huber
 Ikar Inc., Burlington, MA
 Final report (08/1987).
 Availability: AD-820 14J/857
 NTIS

This effort is part of a program aimed at utilizing picosecond pulses to provide superior range resolution in long range radar. The generation of nanosecond pulses requires switches with picosecond risetime and jitter capabilities. The objective of this program was to develop the necessary switching techniques in the picosecond time domain. Apparatus and a measurement technique have been developed and applied to high voltage spark gap switching times in the 10 to the minus 11th power sec time domain. The investigation has included study of electrode material and surface condition leading to ultra-fast closure times in highly overvolted gaps brought about by enhanced high field electron emission. Closure times of 30 psec or less have been achieved. Ultraviolet triggering of overvolted gaps has been observed with jitter as low as 25 psec.

Primary Keywords: Electronic Switches; Sparks; Pulse Generators; Electronic Switches; Radar Pulses; Pulse Generators; Gas Discharges; Ultraviolet Radiation; Electrodes

Secondary Keywords: Nanosecond Pulses; Picosecond Rise Time Switches; Rise Time; NTISDDDXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5324 (ENERGY STORAGE, INDUCTIVE)

(Systems)

THEORETICAL AND EXPERIMENTAL STUDY OF SUPERCONDUCTING INDUCTIVE STORAGE SYSTEMS

O.K. Mawardi, D. Mazony, H.K. Chung and L.D. Holland
 Case Western Reserve University, Cleveland, OH 44106
 AFOSR Report No. AFOSR-76-2886 (10/1978).

Availability: AD A062078
 NTIS

This report covers a two year effort to develop efficient pulse inductive storage sources. Two schemes have been considered in detail. One scheme is based on the electromagnetic model of the classic Marx generator. In the other scheme, a pulse shaping circuit has been used to improve the energy transfer from the storage to the load. In the process of these investigations two types of flux pumps have been investigated. These superconducting devices are ideal to provide the charging current to the inductors. Fast acting pumps were designed and built. Their response is several orders of magnitude better than is currently available. 28 Refs.

Primary Keywords: Inductive Storage; Pulsed; Flux Pump; Shaping Circuit

5325 (PARTICLE BEAMS, ELECTRON)

(Target Interactions)

CHARGING DIELECTRICS WITH A BEAM OF CHARGED PARTICLES

A.A. Vorob'yev, O.B. Yavdokimov and V.N. Gusein'nikov
 FID Reprot No. FID-IDCR(KS)-1448-77 (08/1977).
 Trans. From: Radiotekhnika i Sistemika Metallicheskikh Kristallov 3,
 No. 1, 138 (1977) By M.C. Reynolds

Availability: FID-IDCR(KS)-1448-77
 NTIS

This paper discusses the possibility of charging dielectrics with an electron or radiation beam. The authors consider theoretically the two basic aspects of charge deposition in dielectrics: 1) transport, moderation and thermalization of electrons with the creation of volume charge, and 2) drift, capture, and neutralization of thermal electrons. The authors go on to analyze the most likely conditions for charge buildup and show that this buildup is heavily dependent on beam current. The characteristics of the discharge after completion of the charging process is also considered. 5 Refs.

Primary Keywords: Fast Electron Beam; Gamma Ray Beam; Theory; Dependence On Beam Current; Spallation

5326 (BREAKDOWN STUDIES; PARTICLE BEAMS, NEUTRAL)

(Gas; Electrical; Generation)

CROSS SECTIONS FOR CHARGE TRANSFER COLLISIONS INVOLVING HYDROGEN ATOMS

Y. Kubono, T. Arakawa, Y. Itikawa, T. Imai and T. Kato
 Nagoya University, Nagoya, Japan
 No. ITPJ-AM-15, 18pp (10/1980).

Availability: NSI-14847/0
 NTIS

Experimental data on the cross section for $H + X \rightarrow H + X'$ yields $H(+) + X \rightarrow H(+) + X'$ are compiled for any element X and charge state q. The result is shown in graphs as a function of collision energy. A scaling law for the cross section is derived theoretically to provide quantitative information for highly-stripped ions for which no data are available. Cross sections for some related processes are also shown.

Primary Keywords: Charge Exchange; Collision Parameters; Hydrogen Atoms; Plasmas (Physics); Scattering Cross Sections; Excitation; Graphs (Charts); Ion Density (Concentration); Ion Temperature; Nuclear Fusion; Scaling Laws

Secondary Keywords: Foreign Technology; NTISNASAE; NTISFNJA

5328 (BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Gas Gaps, Materials)

ELECTRODE MATERIAL RELEASE DURING HIGH VOLTAGE BREAKDOWN

R.T. Schneider, T.B. McCall III and H.G. Lohmert
 University of Florida, Gainesville, FL
 NASA Report No. NASA CR-107880 (01/1969).

Availability: M78-17442
 NTIS

This report begins with a comprehensive survey of the available literature in the area of vacuum breakdown and electrode erosion. After pointing out some of the deficiencies and strong points of the existing work, the authors proceed to describe an experiment to measure the eroded electrode mass per shot and to ascertain what happens to this eroded mass. The diagnostics used were neutron activation and gamma ray spectrometry. Several erosion patterns are exhibited, along with pictures of typical breakdowns. An analysis is also given for the fate of the material ejected from the electrodes. 59 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown; Polarity Effects; Material Release; Aluminum Electrode; Copper Electrode

5329

(PARTICLE BEAMS; POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, OPENING)

(Reviews; Pulse Forming Lines; Gas Gaps, Optical; Explosive Fuses)
PARTICLE BEAM FUSION PROGRESS REPORT JANUARY 1980 THROUGH JUNE 1980
 Sandia Labs, Albuquerque, NM 87115
 Sandia Report No. SAND80-2500 (05/1981).

Availability: SAND80-2500
 NTIS

This report provides an overview of the particle beam fusion effort at Sandia Laboratories for the period of January-June 1980. Sections on vacuum ion diodes, analysis of magnetically insulated convolutes, Marx generator development, laser and X-ray triggering of gas gaps, closing switches, and power flow studies are included, as well as sections on plasma diagnostic and fusion target design and analysis. Replicated systems are briefly presented. 189 Refs.

Primary Keywords: PBFA; Proto; Ion Beam; Marx Generator; Magnetic Insulation; Spark Gap; Intrepid Opening Switch; Power Flow; Resonant Transformer; Rep-rated

Secondary Keywords: Particle Beam Fusion; Fusion Target; Plasma Diagnostics

5331

(ENERGY STORAGE, CAPACITIVE)

(Capacitors)

CAPACITORS FOR AIRCRAFT HIGH POWER (FINAL REPORT)

R.D. Parker
 Hughes Aircraft Co, Culver City, CA 90230
 AFMIL Report No. AFMIL-TR-80-2037 (04/1980).

Availability: AD A087427
 NTIS

This report describes an experimental exploratory development program conducted by Hughes Aircraft Company to develop reliable light-weight pulse discharge capacitors for airborne application. The specific duty was a 1 min. burst every 2 hrs., and both low (50 pps) and high (300 pps) repetition rate service was to be considered. The energy density goals were 400 to 1100 J/kg with a 20 microsec. capacitor pulse width. A five layer polysulfone/kraft paper dielectric was selected for high rate service, while polyvinylidene fluoride/kraft paper was chosen for the low rate service. Both mineral oil and diocetylphthalate fluids were used. A highly instrumented test bay accurately simulated a PFM environment and allowed detailed and accurate testing. Three types of complete capacitors were built, one for high rate service. 6 Refs.

Primary Keywords: Capacitors; Pulse Power; Pulse Discharge; Pulsed Capacitors; Pulse Power

Secondary Keywords: Pulse Forming Networks; Energy Storage; Dielectric Systems

5332

(ENERGY STORAGE, CHEMICAL; PULSE GENERATORS)

(Flux Compression Generators; Flux Compression)

AN INTRODUCTION TO EXPLOSIVE MAGNETIC FLUX COMPRESSION GENERATORS

C.M. Fowler, R.S. Caird and W.B. Gorn
 Los Alamos National Labs, Los Alamos, NM 87545
 LASL Report No. LA-5890-M5 (02/1975).

Availability: AD A087427
 LASL

Various types of explosive flux compression generators are illustrated and their relative advantages are compared. Experiments are described in which energy was supplied by these generators. The experiments were selected to show both versatility and limitations of the devices. Generator principles are derived from lumped parameter circuit theory. 15 Refs.

5333

(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Surface Flashover; Solid)

CONTAMINATION EFFECTS ON HVDC INSULATOR FLASHOVER

T. C. Cheng
 University of Southern California, Los Angeles, CA 90007
 EPRI Report No. EPRI EL-1203 (11/1979).

Availability: EPRI EL-1203
 EPRI

An integrated field and laboratory study was conducted to investigate the mechanism of flashover of contaminated insulators under HVDC conditions. The field testing rack, construction at the Sylmar Converter Station, is directly energized by the Pacific HVDC Inter tie. Salient factors identified in the field studies were reproduced under simulated conditions in the laboratory for in-depth studies. Effects of each factor were studied one at a time using a highly controllable laboratory testing procedure. Newly discovered phenomena which occur during the flashover process such as formation of clean zones and the deleterious effect of nitrates on insulating materials, were observed. Theories were formulated to explain the mechanism involved in these phenomena. Electrochemical properties of contaminants and their effects on flashover process were examined. The relationship between single-component salts and multi-component salts was investigated. Experiments on corona initiation on a contaminated insulator were performed. 5 Refs.

Primary Keywords: Insulators; Contamination; HVDC Flashover

Secondary Keywords: HVDC Transmission

COPYRIGHT: 1979 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

5334

(PARTICLE BEAMS, NEUTRAL; PARTICLE BEAMS, NEUTRAL; PARTICLE BEAMS, NEUTRAL)

(Generation; Transport; Target Interactions)

FIELD-REVERSED MIRROR PILOT REACTOR

Authors Unknown (1), Authors Unknown (2) and Authors Unknown (3)
 (1) Lawrence Livermore Lab, Livermore, CA 94550
 (2) General Atomic Co, San Diego, CA 92121
 (3) Pacific Gas And Electric Co, San Francisco, CA 94105
 EPRI Report No. EPRI AP-1544 (09/1980).

Availability: EPRI AP-1544
 EPRI

This report concludes a two-year effort to design a near-term small-scale fusion power plant which, through its construction and operation, would be a direct and important step toward the commercialization of fusion energy. The fusion reactor pilot plant was designed under the ground rules that it must produce net power, be compact, have minimum total cost, and use near-term (late 1980's) engineering technology. The neutral beam driven, field-reversed mirror (FRM) was selected as the fusion plasma confinement concept around which the pilot plant was designed. Although the physics data base for this design is not yet well in hand, it is being pursued within the magnetic field-reversal framework of the U.S. Mirror Fusion Program. Depending on the plasma size, the pilot plant would gross up to 19.8 MW(e) and would produce up to 10.7 MW(e) net, with the recirculated power used principally for the neutral beam injectors and refrigeration for the superconducting magnets. 106 Refs.

Primary Keywords: Deuterium Beam; 11 A, 0.2 MeV Beam; Parallel Beams; Penning Source; Minimum-B Magnetic Well; Edge Bars; Superconducting Magnet

Secondary Keywords: Reactor Design; Tritium Handling; Cryogenic System
COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

5335
(BREAKDOWN STUDIES)

(Gas, Electrical)
STUDY OF ARC BY-PRODUCTS IN GAS-INSULATED EQUIPMENT
Authors Unknown
Gould Inc., Greensburg, PA 15601
EPRI Report No. EPRI EL-1646 (12/1980).
Availability: EPRI EL-1646

EPRI

The project objective was to develop a chemical data base for sulfurhexafluoride, SF₆/sub 6% decomposition products as generated by electrical discharges within gas-insulated equipment to serve as a basis for unified handling procedures of faulted SF₆/sub 6% equipment and disposal of the arc products. An analysis capability was to be developed that could be used to utilize test for incidents and actual fault analysis on SF₆/sub 6% insulated power equipment. Arced SF₆/sub 6% gas and solid samples were generated in test devices which simulate SF₆/sub 6% circuit breakers or SF₆/sub 6% insulated bus. Actual production hardware and procedures were used for assembly of the test devices. Fault arc currents ranged between 15 kA and 58 kA. Arced SF₆/sub 6% samples were obtained and shipped in stainless steel cylinders. Gaseous arc products were analyzed with a combination of gas chromatography-mass spectrometry. The attained sensitivity is 100 ppm. The major SF₆/sub 6% arc products are SF₆/sub 2% and CF₆/sub 4%. The amount increases with arc energy. SF₆/sub 2% can effectively be removed by absorber-scrubbers containing soda-lime, activated alumina and molecular sieves. 8 Refs.

Primary Keywords: Sulfurhexafluoride Gas; Gas-Insulated Equipment; Arcing In Sulfurhexafluoride; Arc By-Products; Faults In Gas-Insulated Equipment

COPYRIGHT: 1980 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED WITH PERMISSION

5336
(PULSE GENERATORS)
(Capacitive)

A PULSED CURRENT SOURCE WITH ENERGY RECUPERATION

G.I. Kugushev and M.D. Sukachev
Instruments And Experimental Techniques, Vol. 17, No. 3, pp 740-741 (06/1974).

Trans. From: Fizika i Tekhnika Ekspеримента 3, 102-103 (May-June 1974). A pulsed power supply of a magnetic lens having recuperation of energy of the magnetic field of the lens into the storage capacitor is described. Stabilization of the charge of the storage capacitor is achieved by cutting off the charging current. The described principle of designing a source ensures a high rate of charging the storage capacitor for high voltage stability at all works. 0.1% this allows an amplitude stability of the current in the load to be obtained which does not exceed 0.03% at a cycling frequency down to 2 Hz. 3 Refs.

Primary Keywords: Energy Recuperation; Thyristor; Inductive Load; Conservation Of Energy; Charging Circuit; Rep-rated; Low Voltage; Low Current

Secondary Keywords: Magnetic Lens
COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

5337
(POWER CONDITIONING)
(Pulse Transformers)

AIRCORE PULSE TRANSFORMERS FOR HIGHPOWER LASERS

G.J. Rothwein

Sandia Labs, Albuquerque, NM 87115

Laser Focus pp. 70-74 (01/1980).

Aircore pulse transformers are proposed as alternative to Marx Generators as power sources for highpower lasers. The advantages and disadvantages in using the aircore transformers are discussed. A comparison of two types of aircore transformers, the helical-wound type and the spiral-strip version, is made. 4 Refs.

Primary Keywords: Aircore Pulse Transformer; Reduced Weight; Reduced Complexity; Flux Linkage; Spiral-strip Transformer

Secondary Keywords: Laser
COPYRIGHT: 1980 ADVANCED TECHNOLOGY PUBLICATIONS

5338
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams, Electron)

Thermal Sensitive Paper As A Diagnostic For Intense Relativistic ELECTRON BEAM DYNAMICS

R.M. Gilgenbach, D.B. McDermott and T.C. Marshall
Columbia University, New York, NY 10027
Review Of Scientific Instruments, Vol. 49, No. 8 pp 1988-1989 (08/1978).

Thermal sensitive paper has been used as a diagnostic for an intense relativistic electron beam propagating in a rippled magnetic field. The E_x-B rotation of the beam has been measured from the exposed pattern on the thermal paper and used to calculate the electrostatic field of the beam and the corresponding values of electron density and beam current. Exposed strips of thermal paper show longitudinal modulation of the radial electron velocity with a period corresponding to that of a rippled magnetic field; modulation of the radial electron velocity at the cyclotron frequency has also been observed. 3 Refs.

Primary Keywords: E-beam Diagnostic; Rippled Magnetic Field; Velocity Modulation; E X B Rotation

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5339
(PULSE GENERATORS; SWITCHES, CLOSING)
(LC; Thyristors)

A POWERFUL THYRISTOR MODULATOR

M.M. Gavrilov, B.M. Kozuev and A.V. Stupin
Moscow Engineering-Physics Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 17, No. 5, pp 1340-1341 (10/1974).

Trans. From: Fizika i Tekhnika Ekspеримента 5, 84-85 (September-October 1974)

A powerful thyristor modulator is described having the following parameters: pulse power 5 MHz, length of the shaped pulse 50 to 300 microseconds, amplitude of the output voltage 1200 V, and the repetition frequency 10 Hz. The basic principle of modulator operation is the principle of complete discharge of the shaping line made up of L-C sections through a matched load. The commutator is a controlled thyristor spark gap shunted by avalanche diodes. Devices of this type may be used in accelerator engineering. 4 Refs.

Primary Keywords: Thyristor; L-C Pulse Generator; Pulse Transformer; 500 A Output Current

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

5340
(ENERGY CONVERSION, THERMAL)
(Loads)

HIGH PULSE POWER FAILURE OF DISCRETE RESISTORS

M. Domingos, (1) and DC Munsch (2)
(1) Polytechnic College of Technology, Potsdam, NY 13675
(2) AFML Wright Air Dev't Center, Wright-Patterson AFB, OH 45433
IEEE Transactions On Parts, Hybrids, And Packaging, Vol. PHP-11, No. 3, pp 225-229 (09/1975).

Theoretical and experimental studies have been conducted on discrete resistors to determine the power required to cause failure as a function of pulse width over the range 1 microsecond to 10 ms. Single pulses of increasing amplitude were applied until voltage breakdown occurred, the resistor shattered, or until a resistance change of 5% or more took place. Carbon composition (both slug and film type), wire-wound (both precision and power type) and film resistors were tested. Computer calculations, temperature cycling tests, and field plots were utilized to interpret the results. 2 Refs.

Primary Keywords: Carbon Resistor; Wire-wound Resistor; Film Resistor; 1 Microsecond-10 Millisecond Pulse Width; Component Destruction

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

5343
(PULSE GENERATORS)

(Systems)

MULTIPLE-CIRCUIT PULSE GENERATOR FOR HIGH REPETITION RATE RARE GAS HALIDE LASERS

C.P. Wang
The Iwan A. Getting Labs, El Segundo, CA 90245
The Review Of Scientific Instruments, Vol. 49, No. 10, pp 1599-1600 (10/1978).

A multiple-circuit high pulse repetition frequency (PRF) pulse generator for the pumping of rare gas halide lasers is reported. With this multiple-circuit design, high PRF can be achieved by the use of existing low PRF thyratron switches and capacitors. A two-circuit pulse generator was constructed, and its performance is described. By means of this pulse generator and a blowdown-type fast transverse-flow system, high PRF laser action in XeF was obtained, typically, 6 mJ/pulse at 1 kHz or 6 W average power. High PRF laser action in N₂/SF₆ was also observed. 12 Refs.

Primary Keywords: Modular Pulse Generator; Low Rep-rate Modules; High Rep-rate System; Capacitive Discharge Circuit

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5344
(PULSE GENERATORS)

(Line Type)

COMPACT MEGAWATT AVERAGE POWER BURST PULSE GENERATOR

J.E. Creedon, J. McGowan, A.J. Buffa and S. Schneider
ECOM, Inc., Monmouth, NJ 07783
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1588-1582 (10/1979).

A compact, lightweight, burst mode pulse generator has been designed and evaluated at a megawatt of average power. The modulator occupies a volume of 0.81 cu m and weighs 225 kg. The recently developed MAPS-40 thyratron and two high-energy density pulse-forming networks (PFN) are used as the switch and energy store. A solid-state end-of-line clipper circuit is included and was found to be essential at high average power loadings. The modulator has been evaluated using a copper sulphate load at 40-kV peak voltage, 40-ka peak current, 10-microsecond pulse width, 40-kA/microsecond current rise, and 50 A of average current at a repetition rate of 125 Hz. Repeated burst on times of 5 s in a 35-s time period have been demonstrated. 4 Refs.

Primary Keywords: High Average Power; Modular Design; Repratted; Hydrogen Thyratron; Design Considerations; Small Size

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5345
(PULSE GENERATORS)

(Hard-tube)

A BROADBAND PULSE POWER AMPLIFIER

V.D. Dvornikov, S.T. Latsukhin and L.Y. Yudin
Atomic Energy Institute, Moscow, USSR
Instruments And Experimental Techniques, No. 2, pp 373-375 (04/1969). Trans. From: Fizika i Tekhnika Ekspеримента 2, 97-99 (March-April 1969).

A circuit is given for a pulse amplifier-shaper that guarantees amplification from 3-5 V to 3 kV with an output current of approximately 20 A in a pulse having a duration of approximately 1 msec. The edges of the output pulse have a duration of 15 to 20 nsec. The amplifier is designed using secondary-emission tubes. The 'GI-30' output tubes guarantee a pulse power of more than 30 kW. 2 Refs.

Primary Keywords: Pulse Amplifier; 5 V Input; 3 kV Output; Fixed Pulse Shape; Secondary Emission Tube; Carrier Pulses

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

5346
(SWITCHES, CLOSING; SWITCHES, OPENING)

(Gas Gaps; Electrical; Gas Gaps; Magnetic Field)

A REPETITIVELY OPERABLE, HIGH-CURRENT INTERRUPTER

R.F. Coristi and D.V. Turnquist
EG&G Inc., Salem, MA 01970
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1482-1490 (10/1981).

A series of fast-acting and repetitively operable bimodal gas discharge switches capable of both the initiation and the interruption of high pulse currents at high-voltage levels has been designed, built, and tested. Based on hydrogen-thyratron technology, these switches attain most of the characteristics of thyratrons when switching them open to the closed state. In addition, the interruption of high currents against high source voltages is achieved when an externally generated, pulsed magnetic field is transversely applied to the current by means of a plasma-field interaction region built into the device. The interruption process is rapid (typically requiring less than 10 microseconds), complete (current reduced to zero), and permanent (the current in the device does not reappear even when the field pulse terminates). In general, operation at lower voltages allows the interruption of higher currents for a given magnetic field energy. Typical data are the interruption of 1000 A against 15 kV with a field energy of 6 J, and 100 A against 50 kV with a field energy of 3 J. The theory, design, and construction of such switches are described, and the results of various parametric studies are discussed. 22 Refs.

Primary Keywords: Thyatron-like Operation; Bimodal Gas Discharge;

Pulsed Magnetic Field; Design Considerations

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5350
(SWITCHES, CLOSING)

(Thyatron)
DOUBLE-ENDED THYRATRONS IN HIGH-POWER BURST MODE PULSE MODULATOR APPLICATIONS

R.B. Molyneux-Berry
BBC Marconi Research Labs., Essex, UK
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1451-1455
(10/1979)

The use of four-gap double-ended thyatron in a 30- to 180-microsecond pulse modulator is described. The FPN-type modulator operates at 195 kV peak, charged from the 11 kV public supply, and powers an ill-matched and potentially unreliable load directly at 30 to 70 kV without a pulse transformer. The maximum repetition rate is 200 pps. The completed modulator has been delivered to the customer and successfully recommissioned. Satisfactory operation is reported with 200-MW, 6-kJ pulses in bursts of average power up to 600 kW; this is well in excess of the published ratings of the tubes employed. The methods used to obtain this performance are discussed and the PFM data are given for single discharge energy and switched charge circuits appropriate to the thyatron used. The possibility of upgrading the modulator is mentioned, and certain recent developments in large thyatrons are discussed. These include a new pentode-type electrode system which should give improved performance with simpler deck circuitry. For extended bursts at long pulse lengths the realistic maximum capability of single tubes in current production seems to be about 1-GW peak at 2-MW average power. 3 Refs.

Primary Keywords: Multigap Thyatron; Pulse Forming Network; Thyatron Systems; Reverse Current Circuit

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5355
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)
A NON-DESTRUCTIVE ACOUSTIC ELECTRIC FIELD PROBE

A. Migliori and J.D. Thompson
Los Alamos National Lab., Los Alamos, NM 87545
Journal of Applied Physics, Vol. 51, No. 1 pp 479-485 (01/1980).

A new method is described for the non-destructive measurement of electric field and space charge distributions inside solid or liquid insulators by using a non-structured acoustic pulse. The integral equation is derived for the response of the dielectric during propagation of an acoustic pulse and some acoustic measurements of electric fields and space charge inside transformer oil and polymethylmethacrylate plastic are described. 7 Refs.

Primary Keywords: Electric Field Measurement; Space Charge

Measurement; Bulk Dielectric; Acoustic Wave

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

5357
(SWITCHES, CLOSING; BREAKDOWN STUDIES)

(Vacuum Gaps; Self; Vacuum, Electrical)

CURRENT GROWTH IN PULSE BREAKDOWN OF A SHORT VACUUM GAP

G.A. Mesyats and D.I. Proskurovskii

Soviet Physics Journal, Vol. 11, No. 1, pp 49-51 (01/1968).

Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii. Fizika 11, 81-85 (1968)

The rise time of the current in breakdown of short (up to 1 mm) vacuum gaps is related to the voltage and gap length; this has been examined by initiation involving heating the anode by field-emission current from the cathode. However, optical studies show that the cathode plays the leading part in determining the current growth. Bright spots appear on the cathode at the start of the monotonic increase in current, and expand toward the anode at about 256 cm/sec. The current and the light intensity increase as the spots spread toward the anode, the current reaching a maximum at the anode. 8 Refs.

Primary Keywords: Vacuum Gap; Millimeter Gap; Delay Measurement; Rise Time Measurement; Optical Measurement; Variable Voltage; Variable Gap Spacing

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

5359
(DIAGNOSTICS AND INSTRUMENTATION)

(Component Testing)

THE DAMAGE SUSCEPTIBILITY OF INTEGRATED CIRCUITS TO A SIMULATED IEMP TRANSIENT

H.L. Vault
Honey Diamond Labs., Washington, DC 20438
IEEE Transactions On Nuclear Science, Vol. NS-20, No. 6, pp 48-47 (12/1973).

Recent investigations have been directed toward gaining insight into the effect of electrical pulses occurring in integrated circuits, specifically, logic gates and bipolar LSIs arrays. In order to determine the effect of ionizing radiation on the pulsed-power failure susceptibility levels of small scale, monolithic, junction-isolated integrated circuits (simple gates), an experimental study was undertaken such that device failures could be induced in a simulated EMP or IEMP environment. The device types investigated included low and high power, quadruple, dual-input, positive NAND TTL gates. Permanent damage levels for these devices were determined for both positive and negative polarity sub-microsecond pulses, introduced into the input, output and bias terminals of active devices, some of which were simultaneously irradiated by gamma radiation. The failure susceptibility level of the device was found to depend uniquely upon the ionizing radiation, the device terminal subjected to the electrical stress pulse, and the polarity of the pulse. The data for device failures in the simulated EMP environment agree with the existing thermal-failure models characterized by $P = At^{\alpha}/\ln t$, where P is the power required to induce failure and t is the time to failure. In a radiation environment it was observed that initial ionization tends to reduce the magnitude of the constant A and shifts the time to failure t from the constant-energy regime ($\alpha = -1$) to another. 13 Refs.

Primary Keywords: Digital Integrated Circuits; Bipolar Logic; Ionizing Radiation; Comparison With Thermal-failure Model

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

5360
(SWITCHES, CLOSING)

(Thyatron)
THE MAPS-40 BURST-MODE 40-KV MEGAWATT AVERAGE POWER HYDROGEN THYRATRON

D.V. Turnquist (1), S.S. Herz (1), R.E. Plante (1), H. Reinhardt (2)
(1) EG&G Inc., Salem, MA 01970
(2) ECOM, Fort Monmouth, NJ 07703

IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1458-1443 (10/1979)

A hydrogen thyatron capable of switching 48 kW and 40 kA in repetitive bursts at the 1-MW average power level is described. Major design problems were obtaining the necessary forward and inverse holdoff capability and controlling the thermal and mechanical effect of the several kilowatts of operating dissipation encountered at this power level. A conventional external anode, planar-electrode, ceramic-metal tube design was chosen to meet the design requirements, which include reliable, kick-off-free operation following long periods of standby. Emission was provided by a large cathode specifically designed to handle ohmic heating due to the 1500 A of rms-equivalent pulse current, as well as the heat developed in the surrounding plasma. Metal mesh anode cooling, and gradient grids incorporated into a tightly baffled coaxial-grid structure of sufficient total aperture area to prevent quenching below 70-80 kA. Molybdenum well shielding was employed to improve holdoff capability and prevent arc damage. Design and operating considerations are discussed and representative test results for the first 16 tubes are given, together with the results of special tests for high peak current, high average current, and high-voltage holdoff. 13 Refs.

Primary Keywords: MAPS-40 Thyatron; Ceramic Thyatron; High Average Power

Copyright: 1979 IEEE, REPRINTED WITH PERMISSION

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5362
(SWITCHES, CLOSING)

(Thyatron)

THE PLASMA-HEATED THYRATRON

D. Fleischer (1), D.V. Turnquist (1), S. Goldberg (1) and H. Reinhardt (2)

(1) EG&G Inc., Salem, MA 01970

(2) 10 Eliot Rd., Lexington, MA 02173

IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1444-1450 (10/1979)

An instant-starting hydrogen thyatron is described which incorporates a cathode requiring no warm-up time, no standby power, and no separate heater power supply. Starting cold, time jitter is less than 1 ns; anode delay time is less than 200 ns; and the 0-30 s anode delay time drift is less than 100 ns. The cathode is a self-heating design made of impregnated tungsten. Even when cold, it provides sufficient emission capability to trigger readily and to prevent arcing. During operation, it attains full operating temperature via plasma-heating effects and its own resistive dissipation; after shutdown, it remains active, in readiness for the next cold start, a cycle which can be repeated as often as desired. Thyatrons made with the new cathode display operating behavior and life comparable to conventional hydrogen thyatrons of equivalent size. 4 Refs.

Primary Keywords: Instant-start Thyatron; Tungsten Cathode; Plasma Heating; Cathode Dissipation Heating; Long Life

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5360
(SWITCHES, CLOSING)

(Thyatron)

100-KV HYDROGEN THYRATRON WITHOUT GRADIENT GRIDS

L. Manzabo
Lawrence Livermore Lab., Livermore, CA 94550

IEEE Transactions On Electron Devices, Vol. ED-18, No. 10, pp 920-924 (10/1971)

A high-power hydrogen thyatron grid-anode structure has been developed using a 59% thyatron cathode assembly. One such device was operated for 10 h at 2000 A, 32 kV, at 1400 pps with a pulse width of 0.3 microseconds. Another was operated for periods up to 220 h at 1000 A, 100 kV, at a duty cycle of 0.00004. The duty cycle is presently limited by our test modulator circuit. Trigger requirements are 2 kV at 50 ohm with a 2.5-microsecond duration. The jitter was nil when measured with a Tektronix 517 oscilloscope using a sweep speed of 50 ns/cm. The anode delay time is in the range of 1/4 to 1/2 microseconds. The grid-anode geometry is designed for a minimum anode-grid capacity, thus providing a tube with a higher repetition rate capability. The field emission limit up to 100 kV is not evident in the normal sense in this geometry. 8 Refs.

Primary Keywords: Grid-anode Structure; Nanosecond Jitter; Rep-rated;

Copyright: 1971 IEEE, REPRINTED WITH PERMISSION

5395
(PULSE GENERATORS)

(Line Type)

HIGH-VOLTAGE NANOSECOND PULSE GENERATOR WITH COMPENSATION USING NONLINEAR COMPONENTS

V.G. Bagranov, D.V. Iremashvili, A.I. Kolesnikov and N.I. Leont'ev
Sukhumi Physicotechnical Institute, Sukhumi, USSR

Instruments And Experimental Techniques, No. 3 pp 1179-1182 (09/1969).

Trans. From: Pribyly i Tekhnika Ekspriemata 5, 89-92 (September-October 1969)

A generator is described which generates pulses by means of a two-stage uniform line. The steepness of the leading and trailing edges of the pulse is increased by connecting a compensating LC network with nonlinear inductance to the anode of a thyatron. Voltage pulses of 30-kV amplitude are generated with a load consisting of load resistance 50 ohm and load capacitance 150 pF. The widths of the leading edge, the top, and the trailing edge of the pulse are, respectively, 35, 70, and 40 ns. The pulse repetition frequency is 25 Hz. 4 Refs.

Primary Keywords: Pulse Generator; Pulse Shaping; Nonlinear Inductor; LC Network

COPYRIGHT: 1969 PLENUM PUBLISHING CORP., REPRINTED WITH PERMISSION

5402

(ENERGY CONVERSION; ELECTRICAL)

(Charging Circuits)

STABILIZATION OF CHARGING VOLTAGE OF CAPACITIVE ENERGY STORAGE ELEMENTS

OF HIGH-POWER PULSED DEVICES

A.M. Leonov and M.M. Oftserov

Radioophysical Scientific Research Institute, Gorki State University,
USSR

Instruments And Experimental Techniques, No. 1, pp 132-134 (02/1969).

Trans. From: "Pribory i Tekhnika Eksperimenta 1, 123-125
(January-February 1969)"A simple method of charging-voltage stabilization is described whose accuracy is not worse than for 0.5% for line voltage variations of $\pm 10\%$; the method is based on the control of thyratron rectifiers. 3 Refs.

Primary Keywords: Thyatron Rectifiers; Lariionov's Circuit; Feedback Circuit

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

5408

(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)

(Flux Compression; Flux Compression Generators)

A COMPRESSED MAGNETIC FIELD GENERATOR SYSTEMS MODEL

J.E. Gover

Sandia Labs, Albuquerque, NM 87115

2nd IEEE International Pulsed Power Conference Proceedings, pp 402-405
(06/1979).

A model relating the volume of a compressed magnetic field generator pulsed power system to its electrical energy output is developed. This systems model includes energy density and/or power density models of the electronic components and a CMF generator model which has been confirmed experimentally for system output energies up to 5000 joules. For a given output energy, there exists an optimum selection of the pulsed power components to give an overall minimum system volume. Under optimum conditions the volume of the CMF generator is equal to one-half of the overall system volume and the overall system volume increases with the one-half power of the systems output energy. In an all electronic system there is a linear relationship between volume and output energy. 6 Refs.

Primary Keywords: Flux Compression Generator; Analysis; Scaling Laws

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5412

(SWITCHES; CLOSING; SWITCHES, CLOSING)

(Gas Gaps, Electrical; Gas Gaps, Materials)

CHARACTERIZATION OF HIGH POWER GAS SWITCH FAILURE MECHANISMS

E.E. Holting

Naval Surface Weapons Center, Silver Spring, MD 20910

2nd IEEE International Pulsed Power Conference Proceedings, pp 450-453
(06/1979).

A multistage, 4 MV, low jitter, command triggered gas switch is being developed for use on large pulse power devices. Experiments to date have shown that the performance and operational life of the switch are severely limited by mechanical and electrical failure of the insulating housing. Estimates of the internal overpressure produced during switch closure have been made which indicate the severity of the blast containment problem. This information has led to the development of a mechanically stronger switch design. Surface analysis of the insulator electrodes and insulator surfaces were used to investigate observed electrical failure of the insulators. A layer of closely spaced metal particles were found imbedded in the insulator walls. 8 Refs.

Primary Keywords: Switch Failure; Very High Voltage; Insulator

Failure; Surface Analysis; Metal Implantation

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5413

(PULSE GENERATORS)

(Reviews)

DEVELOPMENT OF HIGH REPETITION-RATE PULSED POWER GENERATORS

R.J. Sojka and G.K. Simcox

Physic International Co, San Leandro, CA 94577

2nd IEEE International Pulsed Power Conference Proceedings, pp 217-220
(06/1979).The design and development of high repetition-rate, (>1 kHz) pulsed power generators are discussed and a set of chosen design approaches presented. The ensuing technical approaches for the pulse forming network, PFN switching, and PFN charging modulators are described. Key elements of the system are the deionized-mixer, fast-energy store, and a flowing air spark gap switch, both capable of operation at higher than a 1 kHz repetition frequency. Based on this design and development effort, the technical issues of high repetition rate pulsed power systems are discussed, and recommendations are offered for further study and development of dielectrics, spark gap switches, and high power modulators. 4 Refs.

Primary Keywords: Pulse Generator; Reprinted; Design Considerations;

Pulse Forming Network; Switch

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5414

(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Systems; Systems)

HIGH-DENSITY Z-PINCH PULSE-POWER SUPPLY SYSTEM

W.C. Munnally, L.A. Jones and S. Singer

Los Alamos National Labs, Los Alamos, NM 87545

2nd IEEE International Pulsed Power Conference Proceedings, pp 142-147
(06/1979).The design and operation of the high-density Z-pinch experiment pulse-power supply is discussed. A 600-kV, 1-MA, 75-nf Marx bank is designed to charge a 1-ohm, 90-ns, water-insulated transmission line to approximately 0.8-1.0 MV. The water line is then discharged through a small laser-initiated current limiter, a 1.5- μ farad of hydrogen. The components of the Marx bank, the trigger system, the water line, and the gas load as well as the control system that uses fiber optics and air links for monitor and control are discussed. 1 Refs.

Primary Keywords: Marx Generator; Pulse Forming Line; Low Inductance Control System; Optical Trigger

Secondary Keywords: Z-pinch

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5416

(REVIEWS AND CONFERENCES)

(Reviews)

OVERVIEW OF INERTIAL CONFINEMENT FUSION

G.H. Canavan

US Dept. Of Energy, Germantown, MD 20767

2nd IEEE International Pulsed Power Conference Proceedings, pp 1
(06/1979).

Progress and plans for the U.S. program in inertial confinement fusion are reviewed with emphasis on the pulsed power aspects of pellet driver technology. The program has grown in five years from early experiments at the sub-terawatt level to construction of large facilities capable of peak powers on target of about 100 TW. Driver technology options have broadened from glass and CD/sub 2/ lasers to short wavelength lasers, electron and light ion beams, and high energy heavy ion accelerators. Except for the heavy ion drivers, near-term emphasis has been placed on single-shot systems to establish scientific feasibility at greatly reduced cost compared to re-irradiated facilities. However, as the program develops attention must be given to components and subsystems necessary for reliable re-irradiated operation. 0 Refs.

Primary Keywords: Fusion; E-beams; Ion Beam; Re-irradiated

Secondary Keywords: Carbon Dioxide Laser; Glass Laser; Abstract Only

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5417

(PULSE GENERATORS)

(Spiral)

HIGH-VOLTAGE SPIRAL GENERATORS

A. Ramrus (1) and F. Rose (2)

(1) Maxwell Labs Inc, San Diego, CA 92123

(2) Naval Surface Weapons Center, Dahlgren, VA 22448

1976 IEEE Pulsed Power Conference Proceedings, Paper IIIC-9 (11/1976).

The performance of Spiral Generators operating at high output voltage is described. Generators employing castor oil impregnation are compared to those with air insulation. Tests on oil-insulated generators with output capacitance of about 1 nF indicate their high voltage capability is up to 1 MV. Generator failure at high output voltage appears to be caused, in part, by the initial DC charge voltage, thereby limiting the allowable stored energy. Recent preliminary data suggests this limitation can be overcome including resistive paper in the generator winding. Also discussed are switching techniques applicable to Spiral Generators or other sources requiring a low-inductance input switch. Solid-dielectric multichannel switches are found particularly suitable for Spiral Generators. 1 Refs.

Primary Keywords: Spiral Generator; High Voltage; Insulation Considerations; Triggering

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

5418

(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

REBUILDING THE FIVE MEGAJOULE HOMOPOLAR MACHINE AT THE UNIVERSITY OF TEXAS

J.H. Gully, K.M. Tolok, R.C. Zowarka, M. Brennan, W.L. Bird, W.F. Weldon, H.G. Rylander and H.M. Woodson

University of Texas at Austin, Austin, TX 78712

2nd IEEE International Pulsed Power Conference Proceedings, pp 325-329
(06/1979).

The role of the 5 MJ homopolar machine at the Center for Electromechanics has changed from that of a pulsed power supply experiment to that of a power supply for various experiments. Because of this change in duty, it was necessary to modify the machine to allow more efficient operation and easier connection of the machine to the load. The experimental bearings which were on the machine were replaced with bearings of a more conventional design. These bearings exhibit a high stiffness and lower loss than the original bearings, making the machine more reliable and reducing motoring time. The surface of the poles were faced to make the applied field more uniform over the face of the rotor. This reduced the magnetic moment on the rotor and reduced the side forces on the rotor during discharge. The busbars were built to lower the resistance of the output circuit and to allow quicker change of experiments. The latching mechanism on the closing switch was rebuilt for better reliability and a damper was added to lower the mechanical shock on the switch during operation. 2 Refs.

Primary Keywords: Homopolar Generator; Power Supply; High Reliability; Bearing Design

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5419

(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)

(Systems; Systems)

STATUS OF THE UPGRADED VERSION OF THE NRL GAMBLE II PULSE POWER

GENERATOR

J.R. Boller, J.K. Burton and J.D. Shipman Jr.

Naval Research Lab, Washington, DC 20375

2nd IEEE International Pulsed Power Conference Proceedings, pp 205-208
(06/1979).

The GAMBLE II water dielectric pulse power generator, in 1978, was the forerunner of the high energy (>50 kJ) class of water dielectric generators. It has been redesigned internally to make maximum use of its original outer conductor shell and to optimize it for the positive ion beam experimentation. The new design also initiates the use of an oil dielectric multi-channel switch at the output of the pulse forming line. This switch, because of its low capacitance, eliminates the need for an extra prepulse switch. The upgraded version has been tested up to power and energy levels which are nearly twice the original. 0 Refs.

Primary Keywords: GAMBLE II; Water Dielectric; Positive Polarity; Oil Switch; Prepulse Suppression

Secondary Keywords: Ion beam Generation

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

167

5425

(SWITCHES; CLOSING; SWITCHES; OPENING)

(Reviews; Reviews)

A REVIEW OF HIGH-POWER SWITCH TECHNOLOGY

T.R. Burkes, J.P. Craig, M.D. Hagler, M. Kristiansen and W.M. Portney
 Texas Tech University, Lubbock, TX 79409
 IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1401-1411
 (10/1979).

The basic operation and some of the performance parameters and limitations of various high-power switches with potential for aircraft operation are summarized. The specific switches included are: thyatron; ignitrons; liquid metal plasma valves; crossed field tube; vacuum tube; spark gaps (gas, liquid, vacuum and solid); thyristors; transistors; mechanical switches; vacuum arc opening switch; e-beam switches; dielectric surface discharge switches; thermally driven opening switches; and superconducting switches. 55 Refs.

Primary Keywords: Basic Operation; Thyatron; Ignitron; Liquid Metal Plasma Valve; Crossed-field Switch; Vacuum Tube; Vacuum Gap; Spark Gap; Solid State Switch; Surface Discharge Switch; Mechanical Switch; Superconducting Switch

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5431

(SWITCHES; CLOSING)

(Gas Gaps, Electrical)

HIGH POWER SPARK GAP OPTIMIZATION

Authors Unknown
 Maxwell Labs Inc, San Diego, CA 92123
 MLR Report No. MLR-670 (06/1977).

Availability: MLR-670
 NTIS

Maxwell Laboratories presents this final report in completion of the High Power Spark Gap Optimization program. This program was, in effect, a continuation of one started under a contract with Wright-Patterson AFB. In that program, data was obtained in the power range of 1-5 MW to investigate switch performance at rates up to 500 pps and at voltages up to 60 kV. For the maximum power experiments, two switches were connected in parallel to reduce the power delivered to each switch to about 2.7 MW. The minimum minimum pre-fire probability and to demonstrate the feasibility of parallel switches. In the current program, the main experimental objectives were to demonstrate spark gap power above 5 MW per switch and raise operating voltage into the 100 kV range. 3 Refs.

Primary Keywords: Spark Gap; High Power; Medium Voltage; Rep-rated; Theory; Experiment

5432

(BREAKDOWN STUDIES; SWITCHES; CLOSING)

(Gas, Optical; Gas Gaps, Optical)

STUDIES OF TRANSIENT DISCHARGES

P.F. Williams and M.A. Gunderson
 Texas Tech University, Lubbock, TX 79409
 AFOSR Report No. AFOSR-TR-79-1304 (10/1979).

Availability: AD A078894
 NTIS

Progress during the time period June 15, 1978 through June 14, 1979 in this program to study the basic physical processes responsible for laser-induced breakdown of spark gaps is reported. Major accomplishments during the period include (1) the measurement of temporally and spatially resolved electron densities during and after the arc phase, (2) the study of the initial buildup of charge and current in these gaps, and (3) improvements in the data acquisition equipment used in the work. Evidence of a shock front seen in the electron density data was obtained. 19 Refs.

Primary Keywords: Spark Gap; Laser Triggering; Breakdown Modelling; Comparison With Experiment

5433

(BREAKDOWN STUDIES)

(Lightning)

ARTIFICIAL TRIGGERING OF LIGHTNING ABOVE GROUND

Fieux, R. (1), C. Gary (1) and P. Hubert (2)

(1) Electricité De France

(2) CEA, France

1975 Conference On Lightning And Static Electricity, Abingdon, Berks, U.K. (04/1975).

The results of an attempt to trigger lightning using wire-carrying rockets are presented. The purpose of the experiment is to study the potential rise of the upper portions of high-voltage transmission towers. The rocket was launched from the top of the tower under test and pulled the wire to a height of 700 m in approximately 5 sec. Twenty out of 36 shots proved successful in triggering lightning strokes. Analyses of the triggered strokes are presented briefly, with more complete analyses referred to in the references. 16 Refs.

Primary Keywords: Lightning Triggering; Wire-carrying Rocket; Flash Counter; Field Mill; Radioactive Probe

Secondary Keywords: Electric Transmission Tower

COPYRIGHT: 1975 ROYAL AERONAUTICAL SOCIETY

5434

(BREAKDOWN STUDIES)

(Lightning)

INDUCED VOLTAGES, MEASUREMENT TECHNIQUES AND TYPICAL VALUES

B.J.C. Burrows
 Culham Lab, Abingdon, Oxfordshire, UK

1975 Conference On Lightning And Static Electricity, Abingdon, Berks, U.K. (04/1975).

This paper analyzes the voltages induced on internal electronic components and systems produced by lightning strikes on the airframe of an aircraft. The induced voltages are classified as either (1) Airframe return circuits or (2) Two-wire circuits. The effects of voltages produced by current flowing in the resistive airframe and effects of voltages induced by magnetic coupling to apertures in the airframe are considered. Detailed theoretical analyses of the interiors of both the fuselage and wing geometries are included. 7 Refs.

Primary Keywords: Lightning Induced Currents; Aircraft; Theoretical Analyses; Geometry Considerations

COPYRIGHT: 1975 ROYAL AERONAUTICAL SOCIETY

5435

(BREAKDOWN STUDIES)

(Lightning)

A SWEEPSTROKE EXPERIMENT WITH A ROCKET SLED

J.A. Dobbyn and A.W. Henson
 Culham Lab, Abingdon, Oxfordshire, UK

1978 IEEE Electromagnetic Compatibility Symposium pp 390-395 (06/1978). A new method of simulating the sweeping of a lightning stroke has been developed using a moving test vehicle and stationary arcs. Realistic aircraft landing and approach speeds were obtained by using the rocket driven sled installation at the Royal Aircraft Establishment, Farnborough. The sled was used to carry a simulated 'wing' at speeds up to 160 mph. A simple arrangement was used to vary the boundary layer. A unidirectional current pulse with an amplitude and duration in the continuing current range was used. This was generated from a lead acid battery and inductive storage system, which was capable of producing arcs more than 5 meters long carrying 600 A. 9 Refs.

Primary Keywords: Lightning Simulation; Sweep Stroke; Rocket Sled; Inductive Energy Storage; Damage Levels

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

5436

(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Lightning; Electrodes)

ARCS ON METAL SHEETS IN SIMULATED LIGHTNING DISCHARGES

P.F. Little, A.W. Henson and J.A. Dobbyn
 Culham Lab, Abingdon, Oxfordshire, UK

1977 IEEE Electromagnetic Compatibility Symposium pp 375-380 (06/1977). This paper presents a simplified physical model of an arc attachment point, and experimental tests of the validity of this model. The extent of melting in a metal sheet due to a constant-current pulse is measured and compared with theory. Using longer pulses, peak currents, a comparison is made of the observed and calculated times required to puncture the sheet with the calculated value. From this work, new parameters controlling the time to puncture any metal sheet can be identified. The model offers theoretical guidance in determining the minimum metal thickness required for lightning protection and the experimental techniques used here are applicable to simulated lightning tests. 7 Refs.

Primary Keywords: Lightning Simulation; Metal Sheet; Damage Threshold; Puncture Threshold; Experiment; Theory

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

5437

(BREAKDOWN STUDIES)

(Lightning)

INDUCED VOLTAGES IN FULL SIZE AIRCRAFT AT 10/SUP 11/ A/S

B.J.C. Burrows, C. Luther and P. Pownall
 Culham Lab, Abingdon, Oxfordshire, UK

1977 IEEE Electromagnetic Compatibility Symposium pp 207-214 (06/1977). The principal results are given of the preliminary work on induced voltages in idealized wing and fuselage models in which quantitative theoretical predictions were confirmed experimentally. A test rig for subjecting a Hawker Hunter fuselage to current pulses with very high dI/dt (100 kA/microsecond) is described and measurements of the fuselage current distribution and induced voltages on some selected loops are given. A maximum voltage (excluding the high frequency components) of about 2.5 kV was predicted and measured in the cockpit. The h.f. components in the observed induced voltages were investigated by consideration of the current pulse into the fuselage and it was found to contain many discrete frequencies. The amplitude of the initial h.f. components varied in a complex manner with bank voltage and gap pressure, and so scaling of these transient is totally unpredictable. Resonances in the aircraft and its semiconductor structures are discussed. Suggestions are given for standardized test systems to simulate both the high current effects on the aircraft and the effects of streaming current excitation. 7 Refs.

Primary Keywords: Lightning Simulation; Capacitor Discharge; Theory; Experiment; Resonances; Streaming Excitation

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

5438

(BREAKDOWN STUDIES)

(Lightning)

LIGHTNING STRIKE POINT LOCATION STUDIES ON SCALE MODELS

J. Phillipott (1), P. Little (1), E.L. White (2), H.M. Ryan (3), C. Powell (3), S.J. Dale (4), A. Aked (4), D.J. Tedford (5) and R.T. Waters (5)

(1) Culham Lab, Abingdon, Oxfordshire, UK

(2) Electrical Research Association, Leatherhead, Surrey, UK

(3) Airtex Avionics Co. Ltd, Leathley, County Durham, UK

(4) University of Strathclyde, UK

(5) UMIST, Cardiff, UK

1975 Conference On Lightning And Static Electricity, Abingdon, Berks, U.K. (04/1975).

With the multitude of variables involved, the electric fields around an aircraft and, hence, the probability of lightning strike at a given point on the surface of an aircraft is very difficult to calculate. As a result, the authors use the simplified model of a conducting disk with an attached hemispherical vertical post to allow comparison between experiment and theory. An experiment was conducted by placing the simplified model in a point-plane gap and observing the breakdown produced by a pulse generator of variable amplitude, waveshape, and polarity. The size of the model and position in the gap were also varied to provide complete data. The electric fields around the model were calculated and an attempt was made to identify breakdown mechanisms. Results are also presented for detailed models of several aircraft. 8 Refs.

Primary Keywords: Lightning Simulation; Simplified Model; Experiment; Theory; Scale Aircraft Model

COPYRIGHT: 1975 ROYAL AERONAUTICAL SOCIETY

5439

(BREAKDOWN STUDIES)

(Lightning)

RECENT DEVELOPMENTS IN HIGH CURRENT TESTING TECHNIQUES FOR LIGHTNING SIMULATION

A.W. Henson
 Culham Lab, Abingdon, Oxfordshire, UK

1977 IEEE Electromagnetic Compatibility Symposium pp 385-389 (06/1977). This paper reviews the developments that have taken place in testing techniques employed at Culham since 1975. Generation of high current pulse waveforms, waveshaping, arc testing, sweep stroke experiments, testing of entire aircraft, and future plans are discussed. 6 Refs.

Primary Keywords: Lightning Simulation; Pulse Generator; Waveshape; Sweep Stroke; Whole Aircraft Test

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

108

5441
(ENERGY STORAGE; CAPACITIVE; POWER TRANSMISSION)
(Capacitor Banks; Transmission Lines)
DESIGN AND CONSTRUCTION OF FAST ENERGY, HIGH VOLTAGE CAPACITOR BANKS
W. Hess
Lawrence Livermore Lab., Livermore, CA 94550
LLL Report No. UCID-16166 (06/1969).
Availability: UCID-16166
NTIS

This report begins with the identification of the basic parts of a capacitor bank and proceeds to describe each component. Switches and charging circuits are described briefly with more detail given to power transmission and to capacitor selection and failure detection. A short discourse on strip lines and insulator strength is included. Primary Keywords: Capacitor Bank; Capacitor Selection; Capacitor Failure Detection; Charging Circuit; Switch; Transmission Line; Breakdown Data

5443
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Solid; Radiation; Vacuum; Radiation)
QUICKER: A ONE-DIMENSIONAL CODE FOR CALCULATING BULK AND VACUUM EMITTED PHOTO-COMPTON CURRENTS
T.A. Dillin (1) and C.J. MacCallum (2)
(1) Lawrence Livermore Lab., Livermore, CA 94550
(2) Sandia Labs., Albuquerque, NM 87115
Sandia Report No. SLL-76-0218 (04/1976).
Availability: SLL-76-0218
NTIS

The theory and operational features of the one-dimensional code QUICKER are described. The code calculates the bulk and vacuum-emitted photo-Compton current of electrons generated in a material exposed to photons with energies from 1 keV to 10 MeV and arbitrary angle of incidence. The rapid and easy-to-use calculational technique is based on analytical solutions to the transport equation modeling electron multiple scattering and slowing down. 14 Refs. Primary Keywords: Photo-Compton Current; Bulk Current; Emission Current; Vacuum Emission; Quantum Efficiency; Energy Distribution; Numerical Calculation

5456
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Generation; Transport)
ADVANCED SIMULATION RESEARCH: VOLUME II-VACUUM ENERGY STORAGE
W. Clark, A. Mondelli, P. Korn and H. Roskoker
Maxwell Labs Inc., San Diego, CA 92123
DNA Report No. DNA-12974-2 (09/1975).
Availability: AD A048158
NTIS

The STP experiment has been placed in operation during this contract period. A number of electron injectors have been explored with the injected charge shown to scale linearly with the injector bias voltage. Injected charge levels of approximately 100 microcoulombs, which corresponds to potential well depths of about 300 kV, have been measured as will be described in this report. Vertical magnetic field coils have been installed on the experiment, and preparations for high-energy electron injection have been completed. 8 Refs. Primary Keywords: Magnetic Field; Diverter Loop; Azimuthal Drift; Vacuum Energy Storage

5457
(PARTICLE BEAMS, ELECTRON)
(Generation)
AURORA ELECTRON BEAM MODIFICATION
S.E. Graybill
Harry Diamond Labs., Adelphi, MD 20783
HDL Report No. HDL-TR-1852 (07/1978).
Availability: AD A062931
NTIS

The AURORA pulser, which normally operates as a pulsed bremsstrahlung machine, has been modified to inject the electron beam from one of the four lines into a drift chamber. The beam obtained from a hemispherical cathode and a machine charging voltage of 90 kV has been studied in detail. This beam of 100 nA, 20 ns, 300 kJ has produced energy fluxes of 10 to 500 cal/cm²/sec. The energy deposition profile in three materials has been measured and calculated with reasonable agreement. The beam has been successfully used for structures testing, fluidics circuit irradiation, high intensity bremsstrahlung production, and collective ion acceleration. 12 Refs. Primary Keywords: Intense Relativistic Electron Beams; Pinched Beams; Hemispherical Cathode; Energy Deposition Profile

5458
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
COMPRESSSION OF A MAGNETIC FIELD BY A SHELL WITH CONSTANT CONDUCTIVITY
A.Y. Kalago
FTD Report No. FTD-ID(RS)T-0236-78 (03/1978).
Trans. From: Vestnik Moskovskogo Universiteta 5, 88-91 (1971) By C.S. Neck
Availability: AD A067028
NTIS

The authors derive an analytical solution to the problem of an axial magnetic field compressed by an imploding cylindrical conducting shell. Displacement currents are ignored but the finite conductivity of, and field diffusion into, the conductor are included. The limit of infinite conductivity is also taken to show that it reduces to the correct form. The limits of the analysis are demonstrated with a comparison given between the finite and infinite conductivity cases. 10 Refs. Primary Keywords: Magnetic Field Compression; Theory; Analytical Solution; Finite Conductivity

5459
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
CURRENT-MEASURING DEVICES USED WITH THE SUPER-FAST PINCH ASSEMBLY
S.J. Leonard
Space Technology Labs Inc., Redondo Beach, CA
BMD Report No. TR-59-0000-00571 (01/1959).
Availability: AD 609387
NTIS

It was early recognized that the magnitude of the discharge current in the Super-Fast Pinch Assembly was an important parameter. As a result, several current-measuring devices were built and utilized. In addition, methods were developed for checking the calibration of these current-measuring devices in the required range of 20-100 kA at 17 MHz. For current measurement, solenoidal and toroidal coils were used, and they were calibrated against either a two-turn coil or a shunt. Good agreement was obtained among the current values indicated by the various current-measuring coils and by the two calibrating devices. In the report which follows, the various coils and the shunt are described and a summary of the results is given. 0 Refs. Primary Keywords: Current Transformer; Solenoidal Coil; Toroidal Coil; Shunt; High Current; Medium Frequency

5460
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Transport; Target Interactions)
DEVELOPMENT OF AN INTENSE ELECTRON BEAM ENVIRONMENT FOR MATERIAL CHARACTERIZATION
D. Dakin
Physic International Co., San Leandro, CA 94577
DNA Report No. PIFR-21-979 (10/1978).
Availability: AD A069155
NTIS

An intense relativistic electron beam environment has been developed for material characterization. Experimental results on the magnetic compression and expansion of intense beams are presented and compared with theoretical models; emphasis is given to transport efficiency, electron angular distributions, and beam uniformity. Diode energies of 75 kJ are achieved (DNA DML II generator) with greater than 80 percent transport efficiency using a magnetic compression ratio of three. Experimental results have been analyzed in terms of the physics of dielectric impedance lifetime. Several diagnostics essential for characterizing these intense beams have been successfully demonstrated. 15 Refs. Primary Keywords: E-beam; Intense Beam; Magnetic Beam Compression; Materials Response; Beam Diagnostics
Secondary Keywords: Beam Angles; Material Characterization

5463
(SWITCHES, CLOSING)
(Thyristors)
ADIABATIC MODE OPERATION OF THYRATRODE FOR MEGAWATT AVERAGE POWER APPLICATIONS
J.E. Credon, A.J. Buffa and J. McGowan
ECON, Fort Monmouth, NJ 07703
ECON Report No. ECON-4470 (02/1977).
Availability: AD A038687
NTIS

Significant impact on the size, weight, and cost of high energy pulse systems having short on times can be obtained by designing components to operate in the adiabatic mode. Several thyatron design concepts for short term, high peak and average power switching applications have been studied. They include cavity grid designs for high voltage reliability, grid baffling designs to improve anode take over times, and plasma cathode designs to eliminate standby filament power. Using these concepts, several thyatron designs have been fabricated and evaluated at average powers approaching one megawatt. Evaluation of an off the shelf HY-5 operating in the adiabatic mode, was also conducted. It was found that by modifying the cathode structure the device was capable of being operated reliably at 22.5 amperes of average current at a peak voltage of 15 kilovolts. 1 Refs. Primary Keywords: High Power Operation; Cavity Grid Thyatron; Grid Baffling; Plasma Cathode; Performance Test

5465
(SAFETY)
(
BACKGROUND INFORMATION ON HIGH-VOLTAGE FIELDS
D.E.J. Jones
New York University, N.Y. Task Force for Research Planning in Environmental Health Sciences (2nd); Office of Radiation Programs, Silver Spring, Md.; National Inst. of Environmental Health Sciences, Research Triangle Park, N.C.
Final rept. 1970-76 (02/1977).
Availability: PB-273 265/957
NTIS

To conserve fuel and to provide service as economically as possible, the electric utilities have been increasing the operating voltages of overhead transmission lines. Transmission at 345kV began in the mid-1950s. By 1980, it is estimated that 15% of the transmission capability will be at 765kV lines and a prototype 1,100 kV line has to be completed in 1976. Although the bulk of the research evidence suggests that there are no prompt or acute adverse effects on biological systems and the environment from electric and magnetic fields associated with such transmissions, few studies have been designed to detect the effects of long-term exposures. Research needs on this subject include studies using existing electric field environments, studies in controlled simulated environments, studies on medical devices, and dosimetry studies. Included as appendices to the paper are several recently published references on biological effects of transmission lines. Primary Keywords: High Voltage; Power Transmission Lines; Electric Fields; Magnetic Fields; Exposure; Dosimetry; Electric Coronas; Health; Biology; Research Requirements; Recommendations
Secondary Keywords: Environmental Health; Environmental Effects; NTIS/NHEHS

5466 (INSULATION, MAGNETIC)

(
I. Nebenzahl
Cornell University, Ithica, NY 14850
Technical research rept. No. LPS-76, 23p (07/1971).
Availability: AD-750 658
NTIS

A magnetic field can act as an insulator by inhibiting the electrons from transversing a gap between two metallic plates. It is here shown that, if electrons are produced at a high enough rate on the surface of the negative plate, breakdown will occur. The critical current density is given by an equation; or, if the current is space-charge limited, by another equation. The calculation here reported is non-relativistic, i.e. $(V/\text{sub } 0) \gg (E/\text{sub } 0)^2$ is assumed.

Primary Keywords: Electron Beams; Particle Trajectories; Electron Density; Equations Of Motion; Magnetic Fields; Space Charges; Electrostatics
Secondary Keywords: Diamagnetism; Electron Gas

5468 (BREAKDOWN STUDIES)
(Exploding Wires)

CHEMICAL AND PHYSICAL CHARACTERISTICS OF EXPLODING WIRE PRODUCTS
I.J. Russell and J.K. Driscoll
Boston College, Chestnut Hill, MA
(06/1971).

Availability: HYD-3756-6
NTIS

For abstract, see NSA 25 19, number 45030.

Primary Keywords: Antimony; Barium; Cerium; Exploding Wire Phenomena; Indium; Iron; Lanthanum; Molybdenum; Neodymium; Ruthenium; Selenium; Strontium; Tellurium; Tin; Yttrium; Zirconium

5470 TIME-RESOLVED INTENSITY PATTERNS OF THE RADIATION FROM VARIOUS REGIONS OF A VACUUM SPARK DISCHARGE

5472 (BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid, Electrical; Solid)

ELECTRICAL CONDUCTION AND ELECTRICAL BREAKDOWN OF ORGANIC INSULATORS AND SEMICONDUCTORS
H. Ahne, B. Andress, K. Nissen and P. Roehl
Siemens AG Research Lab, Erlangen, FRG
Final Report. No. BHF-T-76-56, 141p (12/1976).
Availability: H77-29415/5ST
NTIS

The results of electrical measurements performed on characterized polyethylene allow formulation of a simplified picture of the conduction mechanism. The conduction current results from electrode-injected electrons and leads to the build-up of a long-lived space charge. Initially the electronic contribution is superposed by a dipolar polarization current, the latter also giving rise to the discharge currents observed. The space charge built up, especially in the presence of impurities and defects, may well influence the electrical breakdown while the material's breakdown strength, of about 800 kV/mm, is relatively unaffected by external parameters.

Primary Keywords: Electrical Faults; Electrical Insulation; Electrical Resistivity; Organic Semiconductors; Polyethylenes; Charge Transfer; Electrical Measurement; High Voltages; Organic Materials; Power Lines; Space Charges
Secondary Keywords: West Germany; Dielectric Breakdown; Breakdown(Electronic Threshold); NTIS/NASAE

Distribution Restriction: In German; English Summary.

5475 (BREAKDOWN STUDIES)
(Exploding Wires)

EXPLORING WIRE FACILITY

A. DiGiacomo
Aerospace Corp, El Segundo, CA 90245
Technical documentary rept. No. TDR-669(6250-30)-1, 22p (10/1965).
Availability: AD-574 478/5ST
NTIS

The installation and calibration of the Material Sciences Laboratory's exploding wire facility are described. The facility provides blast pressure pulses used, for example, in determining the vulnerability of the char layer on ablative materials to impulses representative of shock-on-shock loading. In the original configuration the facility was limited to a maximum over-pressure of 10 psi with a duration in the order of 1.5 msec. Modifications, such as the introduction of a straight tube section and the addition of two capacitors, are presently in progress to obtain higher peak over-pressures. (Author)

Primary Keywords: Exploding Wires; Test Facilities; Calibration; Ionization; Ionization; Shock; Tubes; Ablation; Shock Waves; Subsonic Flow; Transducers; Measurement; Stagnation Points; Circuits; Rectifiers; Capacitors; Resistors; Wiring Diagrams; Piezoelectric Gages; Pressure

Secondary Keywords: NTIS/DOODX
Distribution Restriction: Distribution limitation now removed.

5476 (BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Exploding Wires)

EXPLORING WIRE INITIATION AND ELECTRICAL OPERATION OF A 40-KV SYSTEM FOR ARC-HEATED DRIVERS UP TO 10 FEET LONG
R.E. Dannenberg and A.F. Silve
Ames Research Center, Moffett Field, CA
NASA Report No. NASA TN-D-5126 (04/1969).

This report describes an energy storage and electric-arc driver system for shock-driven facilities. Energy for the arc is supplied from a capacitor bank rated at 1 MJ at an operating voltage of 40 kV. Results are presented for arc discharge lengths of 50 and 110 inches with peak currents of 600 kA. The entire arc strike sequence of exploding wire initiation, dwell period, and subsequent bank discharge is discussed. The composition of the driver gas is shown to be a factor that limits the discharge of stored energy from the capacitor bank. 17 Refs.

Primary Keywords: Exploding Wires; Long Arc; High Energy Density; Wire Variation
Secondary Keywords: Shock Driver

5478 (BREAKDOWN STUDIES)
(Exploding Wires)

EXPLDING WIRE RESEARCH 1774-1963

J.R. McGrath
Naval Research Lab, Washington, DC 20375
Memo. rept. No. NRL-MR-1698, 2p (05/1966).
Availability: AD-633 623
NTIS

A review of Exploding Wires Phenomena (EMP) research is presented. This review covers the work performed from 1774 to the most current publication. Representative and significant studies are cited to indicate the difficulties associated with EMP research and the recent progress made in overcoming them. (Author)

Primary Keywords: Exploding Wires; Reviews; Naval Research; Bibliographies; Vaporization; Electric Currents; Explosions; Electrical Properties; Vapors; Spectroscopy; Metals; Light; Sources; Shock Waves; High Temperature Research; Ignition; Aerosol Generators; Theory

5483 FAIL-SAFE ISOLATION DEVICE PROVIDES MAXIMUM ENERGY TRANSFER FROM EXPLDING WIRE EXPERIMENTS

D.S.F. Zucker
Lawrence Livermore Lab, Livermore, CA 94550
(08/1967).
Availability: UCID-16P68
NTIS

For abstract, see NSA 31 03, number 08119.

Primary Keywords: Electronic Circuits; Design; Detonators; Efficiency; Electric Fuses; Energy Transfer; Exploding Wires; Fabrication; Failures; Signals
Secondary Keywords: NTIS/SEC

5486 (ENERGY CONVERSION, MECHANICAL)
(Rotating Machines)

HIGH POWER STUDY SUPERCONDUCTING GENERATORS
A.E. King, C.C. Kouba, J.L. McClelland and L.D. Smith
Westinghouse Electric Corp Lima Ohio Aerospace Electrical Div
Final rept. 2 Jun 75-1 Mar 76 (03/1976).
Availability: AD-A031 020/851
NTIS

This report summarizes the results of a design study of light weight, high power electrical generators in the 10 to 50 Megawatt range with output voltages up to 200 kV dc (after rectification). Superconducting machines representing the latest technology were the focus of the study; non-superconducting machines utilizing the most advanced conventional design technologies were also studied to develop comparable performance data. Turbine requirements and integration features were studied to ensure compatibility. A separate analysis of MHD electrical generator designs was also carried out to highlight comparable performance data for that type of power source. (Author)

Primary Keywords: Generators; Superconductivity; High Power; Lightweight; Magnetohydrodynamic Generators; Turbogenerators; High Voltage; Pulses; Stators; Rotors; Cooling
Secondary Keywords: Superconducting Generators; NTIS/DODXA

5487 (SWITCHES, CLOSING; SWITCHES, OPENING)
(Miscellaneous Solid State; Miscellaneous Solid State)
HIGH VOLTAGE HIGH POWER TRANSISTORS: CHARACTERISTICS OF DEVELOPMENTAL UNITS

H.M.J. Lawson
Naval Research Lab, Washington, DC 20375
Interim rept. no. 8 No. NRL-MR-1132, 17p (01/1961).
Availability: AD-A045 678/5ST
NTIS

The Radio Corporation of America, under the auspices of Office of Naval Research contract number N0Bsr-81322, has continued development work on silicon power transistors. Eight state-of-the-art samples of this transistor, designated TA-1891, have been tested by the U.S. Naval Research Laboratory for voltage breakdown, output characteristics and saturation voltage. The breakdown voltage of these units is in the range between 400 and 500 volts, and the characteristic is stable with no negative resistance region up to 500 volts. Output characteristics, although satisfactory, should be improved, particularly at low collector voltages. Gain and saturation voltage for these ten ampere units are excellent. A fifty percent improvement in the gain would result in a 20 to 25 ampere unit. Thermal resistance could probably be improved, but is, on the average, adequate at this time for 300 watts dissipation. Two transistors are capable of 450 watts dissipation at 25°C case temperature, even in the interim case provided.

Primary Keywords: Transistors; Acoustic Detection; Test And Evaluation; High Power; High Voltage; Silicon; Electrical Properties; Curves(Geometry); Plotters; Breakdown(Electronic Threshold); Test Fixtures
Secondary Keywords: ROST Project-4; NTIS/DODXA

5488 (PARTICLE BEAMS, ION)
(Generation)

IMPROVED BEAM CURRENT DENSITIES AT HIGH VOLTAGES

J.H. Fink
Lawrence Livermore Lab, Livermore, CA 94550
(08/1976).
Availability: UCID-17235
NTIS

The performance of ion extractors is analyzed with crude approximations that show improved performance to be possible with the certain modifications. However, additional studies are required to evaluate the beam optics in the presence of the deformed grids. (ERA citation 02:018620)

Primary Keywords: Ion Sources; Beam Currents; Beam Extraction; Electrodes; Ion Beams; Plasma
Secondary Keywords: ERDA/700103, NTIS/ERDA

5489

(BREAKDOWN STUDIES)

(Gas, Recovery)

INVESTIGATION OF HIGH POWER GASEOUS ELECTRONICS

H.S. Maddie and J.J. Pergola

Microwave Associates Inc., Burlington, MA

Quarterly rept. no. 3, 1 Aug-31 Oct 66 (02/1967).

Availability: AD-688 279/451

NTIS

An investigation of the role of electron attaching gases in the performance of TR tubes was continued. Attempts at verifying recovery time theory in bromine and chlorine discharge at higher peak powers than previously, met with no success because of gas contamination attributed to discharge induced wall outgassing. An investigation of the bromine recovery characteristic over a 25°C to 330°C ambient temperature range showed no significant variations. This result indicates that the attachment rate is insensitive to electron energies in the thermal range. The TR attenuation theory has been extended to apply to the discharge period as well as to the recovery period. This extended theory correlates leakage as well as recovery time to the parameters of an attachment controlled gas discharge. A skin depth theory has been applied to determine electron density and discharge thickness. (Author)

Primary Keywords: Ion Recombination; Reactions; Bromine; Chlorine; Electron Density; Reaction Kinetics; Electric Arcs; Pressure; Attenuation; Gas Discharges

Secondary Keywords: Recovery Time; NTISDCDXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

5490

(BREAKDOWN STUDIES)

(Exploding Wires)

INVESTIGATIONS OF THE EXPLODING WIRE PROCESS AS A SOURCE FOR HIGH TEMPERATURE STUDIES

E.C. Cassidy and S.B.C.W. Abramowitz

National Bureau of Standards Washington D C

Interim rept. No. NBS-Monograph-109, 59P (11/1968).

Availability: AD-681 912

NTIS

Numerous experiments with electrically exploded wires are described. The results include time-resolved measurements of electrical energy, power, voltage, and current during the discharge; periodic still and high-speed photographs of the entire explosion process; integrated and time-resolved measurements of the intensity and spectral distribution of the radiation emitted; and timeresolved absorption spectra from the products of the discharge, with emphasis on observations of the spectrum of the AlO molecule. The apparatus, instrumentation, and fast-measurement techniques developed in order to permit these direct experimental observations and measurements, under the extreme and transient conditions of the explosive discharge, are also described. Results from calculations of the composition, entropy, enthalpy, and density of the explosion mixture are given. (Author)

Primary Keywords: Exploding Wires; High-temperature Research; Aluminum; Exploding Wire Standardization; Reviews; Design; High-speed Photography; Electric Discharges; Oxygen; Aluminum; Entropy; Enthalpy; Spectra (Visible + Ultraviolet); Spectroscopy

Secondary Keywords: Time Resolved Spectroscopy

Distribution Restriction: Available: Paper copy available from Superintendent of Documents GPO, Washington, D. C. 20402, \$0.55.

5491

(BREAKDOWN STUDIES; BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Electrical; Gas, Electrical; Review)

ELECTRICAL BREAKDOWN OF GASES: THE PREBREAKDOWN STAGE

E.E. Kunhardt

Texas Tech University, Lubbock, TX 79489

IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 130-138 (09/1980).

In this paper, a review of the theories and experiments devoted to the understanding of the development of the electrical breakdown of a gas insulated gap, i.e., the switching delay, is presented. The presentation is chronological. The classical Townsend and streamer models for breakdown are discussed; followed by a brief account of the continuous acceleration and avalanche-chain models. These last two models have been proposed primarily to describe breakdown at large electric fields. Then, the two-group model for breakdown at voltages above approximately 20-percent self-breakdown is presented. Finally, a brief analysis is given of the present state of the field and the direction it is taking. (See Refs.)

Primary Keywords: Prebreakdown Current; Gas Breakdown; Townsend Ionization; Streamer Theory; Continuous Acceleration; Avalanche-chain

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

5492

(DIAGNOSTICS AND INSTRUMENTATION)

(Current)

MEASUREMENT OF FAST RISETIME MEGAMPERE CURRENTS BY QUARTZ GAUGE

R.R. Williams, D.M. McDaniel and R.W. Stinnett

Sandia Labs., Albuquerque, NM 87115

Sandia Report No. SAND 80-0460C (08/1980).

Availability: SAND 80-0460C

NTIS

Quartz gauges have been used on the Sandia National Laboratories Proto II accelerator to measure current in the magnetically insulated transmission lines at the 11 TM power level. The accelerator delivers 1.5 MA at 2514 A/m in a 40 ns pulse to a 0.0127 m diameter aluminum liner to produce a high density plasma. At this radius and dI/dt levels, the B-dot monitors no longer function for the measurement of load current because this monitor suffers electrical breakdown. Quartz pressure gauges mounted at a radius of 0.0086 m have successfully measured the magnetic pressure due to the load current with nanosecond temporal resolution. 2 Refs.

Primary Keywords: Quartz Pressure Gauge; Magnetic Pressure; Fast Rise Time; Very High Current; No Field Perturbation

5494

(INSULATION, MATERIAL)

(Solid)

PHOTOCAPACITIVITY OF HIGH VOLTAGE SPACE INSULATING MATERIALS:

MEASUREMENTS WITH METAL ELECTRODES

H.T. Coffey and J.E. Nanavitz

Stanford Research Institute, Menlo Park, CA 94025

Interim Technical Report, 1 Jul. 1974 - 1 Apr. 1975. No.

NASA-CR-152839, 31p (04/1975).

Availability: AD-23365/85T

NTIS

The electrical conductivities of high voltage insulating materials were measured in the dark and under various intensities of illumination. The materials investigated included FEP Teflon, Kapton-H, fused quartz, and polyimide. Conductivities were determined as functions of temperature between 22 and 100°C and light intensity between 0 and 2.5 kW/m². The thickness dependence of the conductivity was determined for Teflon and Kapton, and the influence of spectral wavelengths on the conductivity was determined in several cases. All measurements were made in a vacuum to simulate a space environment, and all samples had metallic electrodes. The conductivity of Kapton was permanently increased by exposure to light; changes as great as five orders of magnitude were observed after six hours of illumination.

Primary Keywords: Electrical Resistivity; Kapton (Trademark); Photocapacitance; Teflon (Trademark); Electrical Insulation; Light (Visible Radiation); Solar Arrays; Temperature

Secondary Keywords: NTISNASA

5495

(SWITCHES, CLOSING)

(Vacuum Gaps, Plasma-injection)

PLASMA-INJECTION VACUUM ENERGY DIVERTER (CROWBAR)

H.S. Dunkerley

General Electric Co., Schenectady, NY 12301

Rept. no. 4 (Final), 1 Jul 64-30 Jun 65 (02/1966).

Availability: AD-478 494/85T

NTIS

The purpose of this program was to conduct a theoretical and experimental study toward establishing design concepts for high-voltage energy diverters. The approach utilized the relatively new principle of plasma injection for triggering the breakdown of a high-vacuum multiple-section gap. After the initial arc is initiated, the gap returns to a high-vacuum state and voltage hold-off capability, ready for a subsequent controlled operation by the plasma trigger. Studies were made on the effects of electrode materials, geometries, sputtering, vacuum conditions, external geometry, methods of generating the plasma, electron and ion densities and their rate of propagation through vacuum, the trigger geometrical arrangement and location with respect to the hold-off electrodes, use of multiple triggering elements, factors influencing operating range, use of variable spacing and triggering speed, power-handling capabilities and recovery characteristics. The principles studied were used to construct a model of a high-power triggered vacuum gap with an operation objective of 350,000 volts DC. The limited tests results on the model are presented and recommendations for further work. (Author)

Primary Keywords: Plasmas (Physics); Energy Management; Electric Discharges; Trigger Circuits; Electric Arcs; Switching Circuits; Electric Insulation; Plasma Physics; Electrons; Erosion; Electron Tubes; Ions; Performance (Engineering); Injection

Secondary Keywords: Crowbar; Energy Diverters; NTISDDDXD

Distribution Restriction: Distribution limitation now removed.

5496

A 20 KV, NANOSECOND-RISE-TIME PULSE GENERATOR USING KRYTRONS

5499

(BREAKDOWN STUDIES)

(Exploding Wires)

RADIATION GENERATION FROM EXPLODING WIRE

M.G. Bhattacharya, J.P. Craig and T.F. Trest

Texas Tech Univ Lubbock Dept of Electrical Engineering

Final rept. (08/27/76).

Availability: AD-681 007/85T

NTIS

A theoretical investigation has been performed on the dual nature of the experimentally observed x-ray spectra emitted by high power exploded wire plasmas. The observed spectra consist of a steeply decreasing region for photon energies below about 8KeV followed by a nearly constant region above this value. The region of steep decrease is the result of Bremsstrahlung from plasma electrons having a Maxwellian distribution. The constant region was considered as being caused by non-thermal high energy electrons. The constant region was investigated in more detail. They calculated first the Bremsstrahlung spectrum that would result from mono-energetic electrons of 5, 10, 20, 50 and 100 KeV incident on tungsten targets. All the spectra were found to have the same flat shape. The case of non-Maxwellian distribution of electrons was examined using a distribution function appropriate for a homogeneous plasma in a strong electric field. After integration it was found that the spectrum changed from steep to flat as a function of time. It was concluded that a flat spectrum may arise through a distortion of the electron distribution function in a strong electric field. (Author)

Primary Keywords: Exploding Wires; Electromagnetic Radiation; Bremsstrahlung; X Rays; Plasmas (Physics); High Voltage; Photons; Mathematical Analysis; Statistical Distributions; Pulses

Secondary Keywords: NTISDDDXA

5501

(BREAKDOWN STUDIES)

(Exploding Wires)

RECORDING SHOCK WAVES AND EXPLODING WIRE ELECTRICAL CHARACTERISTICS

Y.A. Kotov and M.A. Malnikov

FID, Wright-Patterson AFB, OH

No. FID-97-24-10-68, 15p (07/1968).

Availability: AD-265 489

NTIS

A system for the recording of shock-wave velocities and the current and voltage in an exploding wire is described. The purpose of the present work is to create a source of shock waves with controllable (variable) parameters. The solution of the problem consists in the strict synchronization of the basic elements of the system. The circuitry and its operation are described and its components discussed. (Author)

Primary Keywords: Exploding Wires; Electrical Properties; Shock Waves; Recording Systems; Measurement; Measuring Devices; Electrical + Electronic; Optical Equipment; Synchronization (Electronics); USSR

Secondary Keywords: Translations

//

5504
(INSULATION, MAGNETIC)

)
SIMULATION OF POWER FLOW IN MAGNETICALLY INSULATED CONVOLUTES FOR
PULSED MODULAR ACCELERATORS
D.B. Seidel, B.C. Coplen and J.F. VanDevender
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND 80-1241C (07/1968).
Availability: SAND 80-1241C
NTIS

Recent advances in the technology of magnetic insulation have led to the design of a new class of high power modular accelerators such as PBFA I which is nearing completion at Sandia National Laboratory. In this accelerator, power is fed inward along 36 radially converging, magnetically insulated transmission line (MITL) modules. In many applications, these 36 modules must be recombined into a central magnetically insulated convolute. This recombination can have a significant effect upon the insulation, primarily due to the inevitable lack of simultaneity between the insulations in the 36 MITL modules. In this paper, two distinct simulation approaches for magnetic insulation are developed which can be used to address the question of nonsimultaneity. First, a two-dimensional model for a two-module system is simulated using a fully electromagnetic, two-dimensional, time-dependent particle code. Next, a nonlinear equivalent circuit approach is used to compare with the direct simulation for the two module case. The latter approach is then extended to a more interesting three-dimensional geometry with several MITL modules. 16 Refs.

Primary Keywords: Combinations Of Power From Several Modules; Pulse Simultaneity; Simulation; Numerical Calculation; Particle Code; Nonlinear Equivalent Circuit

Secondary Keywords: Particle Beam Fusion

5508
(BREAKDOWN STUDIES)
(Exploding Wires)

TERMINATED EXPLODING WIRE ENERGY SOURCE
L.A. Rosenthal
Naval Ordnance Test Station, Pasadena, CA
No. NOLTR-65-12, 2p (04/1965).

Availability: AD-618 478
NTIS

By placing a discharge or 'dump' tube across an exploding bridge-wire load, it is possible to bypass the electrical energy and terminate the explosion of the wire. The dump tube is triggered by a signal derived from the energy removed from the storage capacitor. (Author)

Primary Keywords: Exploding Wires; Explosive Initiators; Explosive Initiators; Exploding Wires; Capacitors; Circuits

Secondary Keywords: Exploding Bridge Wires

5509
(BREAKDOWN STUDIES)
(Exploding Wires)

THE APPLICATION OF P.M. BRIDGMAN'S 'NEW EMF' TO EXPLODING WIRE PHENOMENA
K.G. Moses and T. Kornoff
Temple University, Philadelphia, PA 19122

Availability: AD-602 913
NTIS

P.M. Bridgeman propounded the possible existence of a 'New emf' generated in a conductor carrying current due to a local varying temperature. This effect was not detected by any researchers due to the fact that the magnitude of this generated voltage is very small under normal conditions. However, under the conditions of an exploding wire the magnitude of the emf can become increasingly important. It is shown that this effect can possibly account for the excess energy required to melt and vaporize a wire under the extreme conditions of a rapid discharge. (Author)

Primary Keywords: EXPLODING WIRES; ELECTRICAL PROPERTIES; VOLTAGE; THERMODYNAMICS; WIRE; MELTING; VAPORIZATION; ENERGY; HALL EFFECT; CAPACITORS

Secondary Keywords: BRIDGMAN EFFECT

5513
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION;
PARTICLE BEAMS, ELECTRON)
(Current; Voltage; Generation)

VOLTAGE AND CURRENT MEASUREMENTS IN HIFX DIODES
J.D. Silvester

Harry Diamond Labs, Adelphi, MD 20783
Technical Memo. No. HDL-TH-77-6, 126p (08/1977).
Availability: AD-A043 971/1ST
NTIS

Capacitance-voltage (CV) monitors and shunt-resistor (I) monitors have been fabricated for the Harry Diamond Laboratories High-Intensity Flash X Ray Facility. Sensitivities of these monitors have been measured to an accuracy of 10 percent or better by improved pulse techniques. The monitors were used to measure V and I pulses at charge voltages between 2.0 and 5.0 MV for both high- and low-impedance (z) diodes. For the high-z diode, consisting of a hemispherical cathode and a planar anode, Z increases from 70 to 120 ohms as the cathode-anode gap is increased from 1.5 to 3.8 cm. For the low-z diode, the cathode and anode are both planar, Z increases from 7 to 33 ohms as the cathode-anode gap is increased from 0.4 to 1.4 cm. Electron energy spectra calculated from the V and I pulses are in reasonable agreement with those measured previously by means of a magnetic spectrometer. There is also general agreement between the time variation of gamma dose rate calculated from the V and I pulses and that measured with a scintillator-photodiode. However, the doses obtained by integrating the calculated dose rates are, on the average, 70 percent lower than those measured with CaF₂-Rn thermoluminescent dosimeters. (Author)

Primary Keywords: Pulses; Measuring Instruments; Monitors; Diodes(Electron Tubes); Voltage; Electric Current; Field Emission Tubes; Flash Radiography; X Ray Apparatus; Electrical Impedance; High Voltage;

Capacitance; Shunts; Resistors; Electron Energy

Secondary Keywords: NTISDDXA

5514
(SWITCHES, OPENING)
(Explosive Fuses)

CHARACTERISTICS OF A MAGNETIC ENERGY STORAGE SYSTEM USING EXPLODING FOILS
J.N. DiMarco and L.C. Burkhardt
Los Alamos National Lab., Los Alamos, NM 87545

A capacitor bank operating at 15 kJ is used to energize an inductive system of 40 nH. Interrupting the current of approximately 800 kA, by means of an exploding copper foil fuse, produces voltages across the fuse of the order of 80 kV. The opening time of the fuse, as well as the characteristics of the voltage developed across the fuse, are examined as a function of the fuse dimensions. If transfer of the current into a matching inductive load is to take place at the time of peak voltage, energy transfer efficiencies are of the order of 8% with I-dot's of the order of 2E12 A/sec. 9 Refs.

Primary Keywords: Copper Fail Fuse; 15 KV Charging Voltage; 80 KV Output Voltage; Multilayer Fuse

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

5517
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

HIGH VOLTAGE PROBE FOR LIQUID IMMERSION

N.W. Harris
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 45, No. 7, pp 961-962 (07/1974).

A capacitive voltage divider for the measurement of very high voltage transients in liquid-filled transmission lines has been developed. The probe is suitable for pulse lengths in the range 10 nsec to 1 microsecond, and peak voltages between 50 kV and 10 MV. The divider automatically compensates for changes in dielectric constant and loss. 0 Refs.

Primary Keywords: Capacitive Voltage Divider; Liquid Filled; Transmission Line; 10 MV Voltage Range; Compensation

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

5518
(SWITCHES, OPENING)
(Explosive Fuses)

HIGH-POWER PULSE STEEPENING BY MEANS OF EXPLODING WIRES

G.S. Jones and H. Koritz
Arco-Everett Research Lab, Everett 49, MA
The Review Of Scientific Instruments, Vol. 30, No. 11, pp 1032-1037 (11/1959).

A circuit technique is described which reduces the rise times of high power pulses by means of exploding wires. This circuit is a nonlinear lumped parameter transmission line. The magnetic energy is stored in the interstage lead inductances and rapidly transferred into (or more correctly, shared with) succeeding stages by the vaporization of exploding wire resistive fuse elements connected in shunt between the leads. In our case, each of three resistive fuse elements consisted of 20 to 50 parallel 0.001-in diam copper wires held in place across a 2-in. gap with pressure sensitive tape. An empirically determined arrangement is described wherein we have increased the maximum rate of current rise from 3E000 amp/sec/cross-section to 8E000 amp/sec/cross-section. Using this technique, a magnetic field of 10000 gauss is built up in 0.15 microsecond throughout a volume 6 cm in length and 10 cm in diameter. It will be shown that the best results are obtained with high conductivity fuse materials such as copper or aluminum. Similarity theorems are presented for the design of pulse steepening elements for use with circuits having similar pulse shapes but different energies and characteristic impedances. 0 Refs.

Primary Keywords: Pulse Sharpening; Nonlinear Lumped Parameter Line; Multiple Stages; Copper Wire; Aluminum Wire; Dimensional Analysis

COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

5519
(PARTICLE BEAMS, ELECTRON)
(Generation)

MICROSECOND DURATION INTENSE RELATIVISTIC ELECTRON BEAMS

M. Friedman and M. Ury
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 43, No. 11, pp 1659-1661 (11/1972).

A preliminary study was performed to ascertain the feasibility of delivering large quantities of electrical energy in relativistic electron beams of long pulse duration. An electron beam of 8 kA peak current and 250 kV peak voltage was produced with a duration of >1 microsecond. The electron beam was transported through a 1 m long drift tube with little energy loss. 9 Refs.

Primary Keywords: Long Duration E-beam; Foilless Diode; Drift Tube; Guiding Magnetic Field

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

5520
(BREAKDOWN STUDIES)
(Exploding Wires)

EXPLODING WIRES IN STRONG AXIAL MAGNETIC FIELDS

E.M. Honig, M. Kristiansen and M.O. Hagler
Texas Tech University, Lubbock, TX 79409

Journal Of Applied Physics, Vol. 44, No. 14, pp 1923 (04/1973).

Thin copper wires, typically No. 27 and No. 33, were exploded in magnetic fields up to 72 kG. The ambient gas was atmospheric pressure air. The wire lengths were 0.5-1.35 cm, the applied voltage 3-7 kV, the peak currents 3.5-39 kA, and the ringing frequency 300 kHz. The effect of the magnetic field was generally to increase the pause between pulses and to increase the damping of discharge. 1 Refs.

Primary Keywords: Exploding Wires; Copper Wire; Magnetic Field; 72 kG

Field; Air; Increased current reuse

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

5521
(SWITCHES; OPENINGS)
(Explosive Fuses)

RAID TRANSFER OF MAGNETIC ENERGY BY MEANS OF EXPLDING FOILS
C. Maisonnier, J.-G. Linhart and C. Gourian
Lab. Gas Ionizzati, Euratom-CHEM, Frascati, Italy
The Review Of Scientific Instruments, Vol. 37, No. 10, pp 1380-1384
(10/1966)

The rapid transfer of magnetic energy to an inductive load is usually done by discharging a condenser bank, but it can, in principle, also be done by using inductive storage. The problem then is how to open quickly a switch carrying a large current. Using a thin (10 micron) cylindrical foil of aluminum as a switch, energies of the order of 1E4 J have been transferred into an inductance of about 1E-8 H in a few times 1E-7 sec. An elementary theory of the explosion of the foil is presented, and it is shown to agree well with experimental results. Technical problems associated with the construction of such a fast switch can be considered solved up to an energy level of at least 10³ kJ. 5 Refs.

Primary Keywords: Cylindrical Aluminum Foil; Experiment; Theory; Conductivity; Temperature Considerations
COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5527
(BREAKDOWN STUDIES)
(Gas; Electrical)

COMPUTATION OF AXIAL AND RADIAL DEVELOPMENT OF DISCHARGES BETWEEN PLANE PARALLEL ELECTRODES

A.J. Davies, C.J. Evans, P. Townsend and P.M. Woodison
University College of Swansea, Singleton Park, Swansea, Wales
Proceedings Of The IEE, Vol. 124, No. 2 pp 179-182 (02/1977).

A two-dimensional numerical calculation for the simulation of axially-symmetric discharges is presented. Calculations simulating experiments done in nitrogen were made. The simulated shutter and spark photographs were found to agree well with those obtained in the experiments. As the electrode separation increased the cathode the calculation failed due to instabilities that developed. 10 Refs.
Primary Keywords: 2-D Ionization Growth; Plane Electrodes; Parallel Electrodes; Calculated Field Distribution; Photon Flux

COPYRIGHT: 1977 IEE

5531
DIELECTRICS STUDY: FINAL REPORT
DNA Report No. DNA2823F (06/1972).
0 Refs.

5532
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Electrodes; Gas Gaps; Materials)

EXPLOSIVE ANODE EROSION IN HIGH CURRENT SPARKS

K. Schonbach and H. Fischer
Angewandte Physik, Technische Hochschule Darmstadt, Darmstadt, FRG
Applied Optics, Vol. 9, No. 7 pp 1695-1697 (07/1970).
Anode jets believed to be formed by an explosion of material at the anode of a spark gap are studied. The authors discuss the relationship of the jet with current rise, electrode electrical conductivity, thermal conductivity, and boiling point for lead, copper, tungsten, and aluminum. The temporal development of the spark channel and anode jet are presented. It is concluded that the anode jet is formed by local heating of electrons incident on the anode. 4 Refs.

Primary Keywords: Anode Jet; Turbulence; Anode Drop; Dependence On Cathode Material; Thermalization
COPYRIGHT: 1970 AMERICAN OPTICAL SOCIETY

5533
(BREAKDOWN STUDIES; REVIEWS AND CONFERENCES)
(Reviews; Reviews)

INVESTIGATIONS INTO ELECTRICAL DISCHARGES IN GASES
B.N. Klyerfal' Ed.
All-Union Institute, Moscow, USSR
Publisher: The Macmillan Co., NY (01/1964).
Trans. From: The Collected Papers Edited By B.N. Klyerfal' Ed. By D. Cosslett.

This book is a collection of 12 papers by Russian authors concerning discharges in gases and mercury vapor. The first two papers concern the initial phase of self-sustaining discharges in several gases with pd combinations that fall to the left of the minimum of the Paschen curve. Two more papers follow on the plasma spreading of the early part of a discharge and on cathode effects. A good paper follows on postdischarge recovery in several gases. The last seven papers concern processes that occur in mercury vapor arcs (including cathode effects) that include cathode spot observation, temporal histories of mercury vapor densities in discharges, and anode effects. 128 Refs.

Primary Keywords: Self-sustaining Breakdown; Polyatomic Gas; Nonuniform Field; Plasma Spread; Postbreakdown Mercury; Mercury Arc; Cathode Effects; Anode Effects; Plasma Density

COPYRIGHT: 1964 PERGAMON PRESS LTD

5534
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas; Electrical; Surface Flashover)

SWITCHING SURGE AND IMPULSE SPARKOVER CHARACTERISTICS OF LARGE GAP SPACINGS AND LONG INSULATOR STRINGS

T. Udo
Central Research Institute of The Electric Power Industry, Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol PAS-84, No. 4, pp 304-309 (04/1965).

This paper describes the results of sparkover tests made with impulse voltages and switching surges for large gap spacings and long insulator strings under both dry and wet conditions. The tests were conducted at the Shiobara Outdoor Laboratory; a 10,000-kV 750-kA surge generator was used. 6 Refs.

Primary Keywords: Impulse Voltage; Wet Conditions; Dry Conditions; 10 Meter Gap; Air Gap; Cylinder-cylinder Gap
COPYRIGHT: 1965 IEEE, REPRINTED WITH PERMISSION

5535
(BREAKDOWN STUDIES)
(Lightning)

TECHNIQUES OF STRIKE TESTS ON STRUCTURES, COMPONENTS AND MATERIALS

A.W. Hanson
Culham Lab, Abingdon, Oxfordshire, UK

1975 Conference Of Lightning And Static Electricity, pp 1-12 (01/1975).

The lightning simulation facilities at Culham Laboratory are described. The design philosophy behind the pulse generators utilized are discussed, with a comparison with the known characteristics of natural lightning presented briefly. A swept stroke experiment is briefly described. The testing philosophy and various materials responses (heat damage, magnetic forces, etc.) to simulations are discussed in some detail. 0 Refs.

Primary Keywords: Lightning Simulation; Pulse Generator; Swept Stroke; Heat Damage; Induced Effects; Test Philosophy; Diagnostics

COPYRIGHT: 1974 ROYAL AERONAUTICAL SOCIETY

5536
(PARTICLE BEAMS; ELECTRON)

THE GAMBLE I PULSED ELECTRON BEAM GENERATOR

G. Cooperstein, J.J. Condon and J.R. Boller
Naval Research Lab, Washington, DC 20375
Journal Of Vacuum Science And Technology, Vol. 10, No. 6, pp 981-984
(12/1973).

Several modifications, including lengthening of the pulse forming line, to improve the output pulse amplitude and sharply reducing the prepulse amplitude, have been made to the Gamble I electron beam generator. The generator, which consists of a Marx generator charging a water-insulated intermediate storage capacitor feeding a water-insulated pulse forming line, now produces a beam of 750 keV electrons. The major component changes include substitution of triggered gas switches for the previously used water switches and construction of a new diode insulator. 12 Refs.

Primary Keywords: Gas Switch; Diode Insulator; Impedance Transforming Line; Prepulse Reduction

COPYRIGHT: 1973 THE AMERICAN VACUUM SOCIETY

5537
(PARTICLE BEAMS; ELECTRON; INSULATION; MAGNETIC)
(Generation)

TWO SPECIES FLOW IN RELATIVISTIC DIODES NEAR THE CRITICAL FIELD FOR MAGNETIC INSULATION

K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115

Applied Physics Letters, Vol. 28, No. 6, pp 306-308 (03/1976).

An analysis of space-charge-limited counterstreaming flow of ions and electrons in a high-voltage planar diode in the presence of a strong transverse magnetic field is presented. A two-component one-dimensional cold-fluid model is used which includes most self-consistent effects. A substantial enhancement of ion current by a factor of 3-6 is found at fields slightly larger than the critical magnetic insulation field. 14 Refs.

Primary Keywords: Counterstreaming Flow; Space-charge-limited; Planar Diode; Ion Current Enhancement; Magnetic Insulation; Critical Field

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5538
(DIAGNOSTICS AND INSTRUMENTATION)

(Current) SURGE MEASUREMENT ERRORS INTRODUCED BY COAXIAL CABLES

J.H. Park
National Bureau of Standards, Washington, DC 20234

Communication And Electronics, Vol. 77, Pt. 1, No. 37 pp 343-347
(07/1958).

The author considers measurement of pulsed voltages and, in particular, the errors introduced by the coaxial cables used to transmit diagnostic data between sensor and recording medium. Attenuation of the signal due to losses in the conductors and dielectric of the cable are considered, as well as errors introduced by variation in the cable impedance with frequency. Cable termination is also discussed. Suggestions are included for minimization of error and correcting for inherent errors. 4 Refs.

Primary Keywords: Coaxial Cable; Measurement Error; Attenuation; Impedance Variation With Frequency; Termination

COPYRIGHT: 1958 AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

5539
(BREAKDOWN STUDIES)

(Gas; Electrical) THE MECHANISM OF THE LONG SPARK FORMATION

I. Gallimberti
Padova University, Padova, Italy

Journal Of Physics, Vol. 40, No. 7, pp C7-193-C7-250 (07/1979).

Trans. From: Journal De Physique 40, C7-193-C7-250 (Juillet 1979).

The authors present several theoretical and experimental results on the physics of long sparks. The mechanism of breakdown is followed through initiation of ionization through conductive arc channel. The air gap considered is a rod-plane type with a positive pulse applied to the rod. The effects of incoherent radiation is also considered. Diagnostics are discussed. 134 Refs.

Primary Keywords: Long Spark; Rod-plane Gap; Early Phases; Pulse Voltage; Experiment; Theory; Modeling; Diagnostics

5543
(BREAKDOWN STUDIES)

(Gas; Electrical) COMPUTER SIMULATION OF RAPIDLY DEVELOPING GASEOUS DISCHARGES

A.J. Davies, C.S. Davies and C.J. Evans
University College of Swansea, Singleton Park, Swansea, Wales

Proceedings Of The IEE, Vol. 116, No. 6, pp 816-823 (06/1971).

A detailed description is presented of the numerical simulation of a high-growth-rate gaseous discharge. The main feature of this simulation is Townsend ionization and field distortion due to the presence of space charge. The simulation proceeds from an initially uniform field with a small core of electrons emitted from the cathode to full breakdown. Cathode and anode streamers are predicted successfully. Agreement with the experimental results of Wagner in nitrogen are seen to be good. 7 Refs.

Primary Keywords: Townsend Breakdown; Space Charge; Electric Field Distortion; Anode Streamer; Cathode Streamer; Numerical Simulation

COPYRIGHT: 1971 IEE

5545
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

COUPLING BETWEEN OPEN AND SHIELDED WIRE LINES OVER A GROUND PLANE
R.J. Mohr
Cutler-Hammer Inc., Deer Park, NY
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-9, No. 2,
pp 34-47 (09/1967).

Convenient expressions are derived which permit accurate determination of induced interference in open unshielded wire and shielded wire or coaxial lines due to AC and transient currents. Curves and tables are presented for obtaining key parameters in the calculation of interference. The limitations of the derived expressions are set forth and an example interference problem is solved. Experimental verification of the analysis is presented. 7 Refs.

Primary Keywords: Analytical Expressions; Coupling Coefficient; Several Geometries; Attenuation Effectiveness; Experiment; Theory

COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION

5547
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

ELECTROMAGNETIC-INTERFERENCE CONTROL

E.F. Vance
Stanford Research Institute, Menlo Park, CA 94025
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-22, No. 4,
pp 319-328 (11/1980).

The use of shield topology concepts to design interference control is described. Starting with the postulate that electromagnetic environments can be separated by closed shield surfaces, the proper design of essential conductors such as insulated power and signal conductors, earthings, for access and ventilation are deduced. The role of grounding is described and the relation of ground conductors to shield surfaces is deduced. Some guidelines are given for determining how effective the shield needs to be. It is concluded that the effectiveness of a shield is usually limited most by interference propagating on insulated conductors passing through the shield, followed by leakage through apertures and diffusion through the shield walls. 8 Refs.

Primary Keywords: Shield Topology; Grounding; Design Considerations; Effectiveness Analysis

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

5549
(ELECTROMAGNETIC COMPATIBILITY)

(Grounding And Shielding) GEOMETRICAL EFFECTS ON SHIELDING EFFECTIVENESS AT LOW FREQUENCIES

D.A. Miller and J.E. Bridges
Illinois Institute of Technology, Chicago, IL
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-8, No. 4,
pp 174-182 (12/1966).

A frequent approach to computing the magnetic shielding effectiveness of enclosures is to consider the effect of plane wave impinging on a sheet of infinite extent. This makes an analysis based on a transmission-line characterization. However, when the wave-length is large compared to the dimensions of the enclosure, other analytical approaches provide better results. It has been shown that the current distribution on a box-like object scattering in the Rayleigh region tends to concentrate at the edges and corners of the box. This leads to concentrations of the magnetic field in the vicinity of edges and corners both inside and outside the enclosure. Since the effects of the current concentrations are localized, the magnetic shielding problem can be simplified by assuming a uniform current distribution on the exterior of the enclosure. Under this assumption the so-called "circuit approach" can be applied. 10 Refs.

Primary Keywords: Low Frequency; Corner Effects; Shorted Transformer; Mutual Impedance; Leakage Impedance; Circuit Approach; Scattering Theory; Comparison

COPYRIGHT: 1966 IEEE, REPRINTED WITH PERMISSION

5550
(REVIEWS AND CONFERENCES; ELECTROMAGNETIC COMPATIBILITY)

(Reviews; Grounding And Shielding) GROUNDING AND SHIELDING TECHNIQUES IN INSTRUMENTATION

R. Morrison
Dynamics Instrumentation Co.
Publisher: John Wiley And Sons, Inc. New York, London, Sydney (01/1967).
Though proper grounding and shielding techniques are an important consideration in any pulsed power system, these are often not dealt with until they become a difficult problem. The author of this book shows, beginning with basic field theory, how to incorporate proper grounding and shielding systems into a pulsed power environment. Consideration is given to choosing a good ground for the system and to dealing with the common system grounds. Both electrostatic and magnetic shielding techniques are presented.

Primary Keywords: Grounding; Shielding; Instrumentation; Field Theory;

Power Supply Isolation; Isolation Transformer

COPYRIGHT: 1967 JOHN WILEY & SONS, INC.

5551
(ELECTROMAGNETIC COMPATIBILITY)

(Grounding And Shielding)

LOW-FREQUENCY SHIELDING EFFECTIVENESS OF A DOUBLE CYLINDER ENCLOSURE
P.A.M. Kirk
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-19, No. 1,
pp 14-21 (02/1977).

The low-frequency shielding effectiveness of a long double cylinder shield is determined through a solution of Maxwell's field equations. The shielding expression obtained is then compared with the results obtained by both the circuit approach and the transmission line analogy. The findings of the present paper are also compared with the analysis by previous authors of the multishield problem. A digital computer program for numerical evaluation of the effectiveness of a double cylinder shield is developed and used to study the influence of the shield dimensions and material constants. 16 Refs.

Primary Keywords: Low-frequency Shielding; Double Cylinder; Maxwell's Equations; Analytical Solution; Planar Shielding; American Circuit Approach; Transmission Line Analogy

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

5552
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

MAGNETIC SHIELDED ENCLOSURE DESIGN IN THE DC AND VLF REGION
A.K. Thomas
TRW Systems Group, Redondo Beach, CA
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-10, No. 1,
pp 142-152 (03/1968).

A review of magnetic shielding concepts and equations as applied to ideal shield configurations has provided a basis for the analysis of the shielding effectiveness of practical shielded enclosures to DC and VLF magnetic fields. The permeability of the shield material is considered as a function of the induction, and a significantly improved method of estimating the induction and permeability of the shield is presented. The effects of multiple shell geometry are given by the equations of this analysis, which are indeterminable with a transmission line analysis. The degrading effects of other departures from ideal shield materials and configurations are analyzed qualitatively; equations for estimating the magnitude of these effects are developed where possible. 13 Refs.

Primary Keywords: Magnetic Shielding; Shielding Concepts; Design Criteria; Induction Estimation; Multiple Shields

COPYRIGHT: 1968 IEEE, REPRINTED WITH PERMISSION

5554
(REVIEWS AND CONFERENCES; ELECTROMAGNETIC COMPATIBILITY)
(Reviews; Grounding And Shielding)

NOISE REDUCTION TECHNIQUES IN ELECTRONIC SYSTEMS
H.W. Ott
Bell Labs, Whippany, NJ
Publisher: John Wiley & Sons New York, London, Sydney, Toronto (01/1976).

This book presents a comprehensive study of electrical noise and its elimination. The basic mechanisms of noise generation are presented with methods included for the reduction of each type. Grounding and shielding techniques for the elimination of coupling between circuits are discussed in detail with quantitative comparisons of various configurations. Protection circuits for mechanical switch contacts are included. Inherent noise sources in electronic devices, shot noise, etc., are discussed with reduction techniques included. The book is designed to be utilized with electronic circuits, almost all of the techniques presented can be used in a pulsed power environment. 108 Refs.

Primary Keywords: Grounding; Shielding; Electrostatic; Magnetic; Capacitive Coupling; Inductive Coupling; Radiative Coupling; Thermal Noise; Shot Noise; Filtering; Coding

Secondary Keywords: Mechanical Switch

COPYRIGHT: 1976 BELL TELEPHONE LABORATORIES, INC.

5555
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE CATHODE FALL OF AN ARC
R.C. Mason
Research Labs, Westinghouse Elec. And Mfg. Co., East Pittsburgh PA
Physical Review, Vol. 38, pp 427-441 (08/1931).

Schottky and classical theory are used to derive the energy distribution of electrons in the cathode fall of an arc. Both thermionic and field emission at the cathode are considered with the main thrust of the paper centering around a theoretical study and experimental test of Langmuir's theory of required high field for field emission of electrons. Conclusions are presented that either Langmuir's theory is incorrect or a very complicated ionization process occurs to produce the required positive ions. 26 Refs.

Primary Keywords: Cathode Fall; Thermionic Emission; Field Emission; Space Charge; Langmuir's Theory

COPYRIGHT: 1931 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

5556
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE FALL OF POTENTIAL IN THE INITIAL STAGES OF ELECTRICAL DISCHARGES
J.C. Street and J.W. Beams
University of Virginia, VA

Physical Review, Vol. 38, pp 416-426 (08/1931).

Data are presented concerning the voltage history of the early stages of gas discharges in this paper. The fall of the discharge voltage in air, hydrogen, and CO₂/air is investigated for the pressure range 50-140 cm of Hg and seem to be in good agreement with Toepler's discharge law. Possible methods are discussed for increasing the rate of voltage fall for discharges in these gases. 13 Refs.

Primary Keywords: Voltage Fall; Time History; Several Gases; Wide Pressure Range; Impulse Voltage

COPYRIGHT: 1931 AMERICAN PHYSICAL SOCIETY

5559
(BREAKDOWN STUDIES)

(Gas, Electrical)

THE MECHANISM OF THE ELECTRICAL BREAKDOWN OF AIR IN UNIFORM FIELDS AT VOLTAGES UP TO 400 KV
J. Dutton and W.T. Morris
University College of Swansea
British Journal Of Applied Physics, Vol. 18, pp 1115-1120 (03/1967).

This paper presents the results of the measurement of pre-breakdown currents at a pd of over 12000 voltages of 16 to 400 KV constrained the fields to the less than 50 KV/cm, which reduced field emission to a negligible level. The secondary ionization coefficient was measured and found to be highly dependent on the condition of the cathode surface. Experimentally observed values of ionization growth agreed well with the generalized Townsend equation in all cases. 13 Refs.

Primary Keywords: Pre-breakdown Current; Uniform Field; Secondary Ionization Coefficient; Townsend Discharge; Modified Fowler-Nordheim Equation

COPYRIGHT: 1967 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5560
(BREAKDOWN STUDIES)
(Gas; Electrical)
TRANSITION FROM THE PRIMARY STREAMER TO THE ARC IN POSITIVE
POINT-TO-PLANE CORONA

T. Suzuki
University of California, Berkeley CA
Journal Of Applied Physics, Vol. 42, No. 10, pp 3766-3777 (09/1971).
This paper reports for the first time measurements with multiple techniques delineating the complete sequence of events from the primary streamer to the thermalization of a highly ionized channel to the arc phase in the common spark transition for relatively small point-to-plane gaps. The observations cover a range of point diameters from 0.1 to 2 mm, for gaps in room air from 1 to 4 cm long, covering the whole range of potentials from streamer onset to in excess of 30% above the standard sparking threshold. It is shown that starting with the primary streamer, which occasionally at its start creates photoionization up to the midgap and at the cathode, there is produced a succession of ionizing waves of potential starting in many cases on the arrival of its tip at the cathode. These waves, observed by photomultipliers as well as by current pulses over a period of some microseconds, create what has been called a 'secondary streamer' by Hudson and Loeb. Unless overvoltage exceeds 30%, the electron density and temperature in the resulting channel are not adequate to thermalize to an arc. Above this value thermalization occurs in several hundred nanoseconds. At lower overvoltages there is a dark phase lasting at low values for hundreds of microseconds. 26 Refs.
Primary Keywords: Streamer; Arc Channel; Spark Transition; Photoionization; Cathode Effects; Thermalization
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5562
(BREAKDOWN STUDIES)
(Gas; Microwave)
EXPERIMENTAL INVESTIGATION OF THE TRANSIENT FORMATION OF A
MICROWAVE-GENERATED IONIZED SPEATH IN AIR

S. E. El-Khemy and J. E. McIntire
University of Massachusetts, Amherst, MA 01002
Journal Of Applied Physics, Vol. 46, No. 1, pp 100-105 (01/1973).
Microwave and photometric techniques are used to study the temporal and spatial behavior of a transient microwave-generated air plasma sheath in a coaxial transmission line. In particular, breakdown times, stabilization times, and thickness of the ionized sheath are investigated at different pressures and generating signal amplitudes. 22 Refs.
Primary Keywords: Microwave Ionization; Coaxial Transmission Line; Breakdown Time; Diagnostics
COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5564
(BREAKDOWN STUDIES)
(Solid; Electrical)
SOME ASPECTS OF DIELECTRIC BREAKDOWN OF SOLIDS

D. R. Watson, W. Neves, K. C. Kee and J. H. Calderwood
Royal College Of Advanced Technology, Belford, UK
IEEE Transactions On Electrical Insulation, Vol. EI-1, No. 3, pp 30-37 (11/1965).

The electric strengths of sodium chloride, polythene, and polymethyl methacrylate were measured using direct and impulse voltages at room temperature. The effects of specimen thickness, electrode radius, and rate of rise of applied field are different in degree from material to material indicating the importance of prebreakdown conditions. It is suggested that the final breakdown mechanism is of the avalanche type, heating by prebreakdown current and the formation of space charges being factors affecting its occurrence. 21 Refs.
Primary Keywords: Dielectric Strength; Several Materials; Impulse Voltage; Several Geometries; Analysis Of Mechanisms
COPYRIGHT: 1965 IEEE, REPRINTED WITH PERMISSION

5566
(BREAKDOWN STUDIES)
(Surface Flashover)
THE EFFECT OF CUPROUS OXIDE COATINGS ON SURFACE FLASHOVER OF DIELECTRIC
SPACERS IN VACUUM

J. D. Cross and T. S. Sudarshan
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-9, No. 4, pp 148-151 (12/1974).

An experimental investigation of the effect of a cuprous oxide coating upon the surface flashover of high-density alumina in vacuum is reported. It is shown that such coatings improve the impulse strength of the system and eliminate the conditioning effect observed in the case of uncoated specimens at DC and 60-Hz voltages. An explanation of the observed behavior is given in terms of a surface charging model. It is postulated that the improvement in the insulation by the coatings is due to a reduction in the secondary electron emission yield. 8 Refs.
Primary Keywords: Coating; Increased Breakdown Strength; No Conditioning Effect; Low Frequency Field; Modeling; Surface Charge
COPYRIGHT: 1974 IEEE, REPRINTED WITH PERMISSION

5567
ELECTRODYNAMIC PULSE GENERATOR

A. I. Bertinov and D. A. But
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RSYT)-2092-77, 10p (12/1977).
Availability: AD-A065 843/557
NTIS
No abstract available.
Primary Keywords: Pulse Generators; Translations; USSR
Secondary Keywords: Patents; N15DODXA; N15FNUR

5569
(SWITCHES, CLOSING)
(RBDT)

COMPLETE CHARACTERIZATION STUDIES PROVIDE VERIFICATION OF RBDT (RSR)
RELIABILITY

J. B. Brewster (1) and G. F. Sherbondy (2)
(1) Westinghouse Electric Corp, Pittsburgh PA
(2) Westinghouse Electric Corp, Youngwood, PA
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1462-1468 (10/1979).

This paper presents the latest characterization information available for a two-terminal, high-speed, solid-state switch previously called the RSDT (Reverse Switching Rectifier) but presently referred to as the RBDT (Reverse Blocking Diode Thyristor). Studies of the RBDT have been continuing, leading to considerably less characterization than had previously been available. Loss characterization and triode studies were made concurrently, and the results show that with proper triggering, the RBDT will function reliably and with minimum loss. New test equipment, which tests to customer specified load conditions is described. The paper concludes with a summary of field originated life data, which supports the conclusion that the RBDT may be effectively and reliably applied for short-pulse, high-current, high rate-of-rise duty. 3 Refs.
Primary Keywords: Reverse Blocking Diode Thyristor; Reverse Switching Rectifier; Characterization; Losses; Triggering
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5572
(ENERGY CONVERSION, THERMAL)
(Loads)

LOW-INDUCTANCE, LOW-IMPEDANCE MEGAWATT AVERAGE POWER LOAD
W. Wright Jr.,
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1556-1559 (10/1979).

A compact, low-inductance, 0.5-ohm, 1-MW average power resistive load has been developed to facilitate testing of the MAPS-40 thyatron. The flowing liquid electrolyte system has the large thermal mass of a storage tank of electrolyte to store the energy which is dissipated through a heat exchanger after the high-power run. The electrolyte starting temperature, flow rate, and allowable temperature rise determine the maximum average power into the load; the external and internal spacings and flow uniformity determine the maximum peak power; the flow rate and storage volume determine maximum running time. The load assembly consists of two parallel glass pipes 10.2 cm in diameter and 15.25 cm long. The active volume in each pipe is 6.35 cm long and is contained between electrodes 8.9 cm in diameter. The two sections of the load are electrically in parallel and flowing in series, putting both flow connections at ground potential. The major problem was getting the internal flow pattern uniform to eliminate local boiling and arcing across the bubbles while keeping the pressure drop low and flow high. The calculated inductance of the load assembly is 11 mH and the structure lends itself to parallel connections which reduce the overall inductance still further. Material compatibility with the electrolyte will be discussed. 3 Refs.
Primary Keywords: Dummy Load; High Average Power; Low Inductance; Low Resistance; MAPS-40 Thyatron; Design Considerations
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5573
(PULSE GENERATORS)
(Systems)

MODULATOR CHARGING SYSTEM UPGRADE FOR A 5-MEV ELECTRON ACCELERATION
D. Rogers Jr., W. Dexter, L.L. Reginato and A. Zimmerman
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1509-1511 (10/1979).

The Lawrence Livermore Laboratory is currently constructing a new linear induction accelerator with a higher beam current than the Astron Accelerator. The new accelerator, called the Experimental Test Accelerator (ETA), will be a 5-Mev, 10-kA accelerator with a pulselwidth of 50 ns. Like the Astron, the principle of magnetic induction is used to obtain a linear accelerator. The modular accelerating cavities form essentially a 1:1 transformer and the change in flux in the ferrite core induces an axial electric field for the acceleration of electrons. Since the total energy storage for the ETA is much greater than the requirement for Astron, the power system, the capacitor bank, and the modulator charging system all had to be modified to provide an overall regulation of 0.1 percent. This strict regulation of the charging voltage is necessary for pulse-to-pulse repeatability. 2 Refs.
Primary Keywords: Electron Beam Accelerator; Hard Tube Modulator; Charging Circuit; Power Supply; High Average Power; Very Good Voltage Regulation
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

5574
(BREAKDOWN STUDIES)
(Vacuum; Electrical)

IMPULSE-VOLTAGE BREAKDOWN CHARACTERISTICS OF LARGE GAPS AT LOW PRESSURES
M. R. Mandegarpour and H.V. Gopalakrishnan
Indian Institute of Science, Bangalore, India
Journal Of Applied Physics, Vol. 42, No. 13, pp 5874-5876 (12/1971).

A study of the gap breakdown voltage characteristic at a low pressure of 1E-5 Torr with a standard (1/50)-microsecond impulse-voltage wave reveals an agreement with the criterion $V/\sqrt{5} = Cd/\mu$ 0.5/ suggested by Cranberg. Voltage-time-to-breakdown characteristics have also been determined. From these studies, it is concluded that impulse breakdown in vacuum is initiated by an electron current heating an anode spot and thereby liberating a clump which causes breakdown. 3 Refs.
Primary Keywords: Breakdown; 1E-4 Torr Pressure; Impulse Voltage; Cranberg Criterion; Delay Measurement; Anode Heating
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5575
(SWITCHES, CLOSING)
(CLASS)

OPTICAL DRIVE REQUIREMENTS FOR LASER-ACTIVATED SEMICONDUCTOR SWITCHES
P.G. McMullin and L.R. Lowry
Westinghouse Electric Corp., Pittsburgh PA
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1469-1472
(10/1979).

Laser-activated semiconductor switch (LASS) devices of the thyristor type exhibit three regimes of operation. At low optical drive, optical triggering is obtained with delay time before conduction and relatively low current rise rates. At intermediate drive levels, fast switching is obtained with no appreciable delay time and fast current rise rates (greater than 10⁹ A/s) but with substantial power loss in the switch element. At higher optical drives, saturated switching is observed with the rise rate and power loss relatively independent of the optical drive level. LASS thyristors of 1- and 4-kV operating voltage ratings have been characterized in the lossy fast switching regime. For pulses of 100-ns duration, the devices act as resistive elements. The magnitude of the resistance varies inversely with the optical drive, as can be understood as conductivity modulation of the conduction path by the photo-generated carriers. Such characterization allows switch system design tradeoff between the required optical drive level and the tolerable power loss in the switch elements. 4 Refs.

Primary Keywords: Thyristor; Optical Triggering; Variation With Trigger Level; Small Delay; Fast Rise; Performance Test

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

5576

GENERATOR OF POWERFUL CURRENT PULSES

F.M. Spevakova and A.M. Stolov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)T-0050-78, 9p (01/1978).
Availability: AD-A066 071/9ST
NTIS

No abstract available.

Primary Keywords: Electric Generators; Magnetic Fields; Electric Current; Current Regulators; Translations; USSR
Secondary Keywords: Pulse Generators; NTISDDDXA; NTISFNUR

5577

(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Surface Flashover; Solid)
COLLOQUIUM ON ELECTRICAL BREAKDOWN ON INSULATING SURFACES
T.A.J. Kitchen
Office of Naval Research, London, UK
Conference rept. No. ONRL-C-1-76, 8p (01/1976).
Availability: AD-A021 853/7ST
NTIS

A one-day colloquium on electrical breakdown on insulating surfaces was held by the Institution of Electrical Engineers in London on 6 November 1975. Three introductory talks and a half a dozen contributed papers were given summarizing the state of the knowledge of electrical breakdown in practical systems and some recent research on various aspects of the subject. (Author)

Primary Keywords: Electric Discharges; Insulation; High Voltage; Electrical Insulation; Electrical Properties; Surfaces; Vacuum; Decomposition

Secondary Keywords: Electrical Breakdown; Hydrofluoric Acid; Insulating Materials; NTISDDDXA; NTISODDH

5578
(PARTICLE BEAMS, ION)

(Generation)

DEPENDENCE OF THE ION CURRENT ON VOLTAGE IN A REFLEX TRIODE
C.A. Kapetanakos, J. Golden and W.M. Black
Naval Research Lab., Washington, DC 20375
Physical Review Letters, Vol. 37, No. 18, pp 1236-1239 (11/1976).
Results are reported on the dependence of the current of a pulsed ion source on the voltage applied upon the applied resistive voltage in the range 0.6 to 1.3 kV. The measured peak ion current at the maximum voltage tested is 20 kA, corresponding to a current density of 200 A/cm.² 14 Refs.

Primary Keywords: Ion Beam Generation; Reflex Triode; 0.6-3 MV Voltage Range; 20 kA Current

COPYRIGHT: 1976 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

5580
(SWITCHES, CLOSING)

(CLASS)

DEVELOPMENT AND APPLICATION OF LIGHT ACTIVATED SILICON SWITCHES

J.S. Roberts, D.R. Muss and R.A. Hill
Westinghouse Research and Development Center, Pittsburgh PA
Final rept. May 68-May 70 No. 69-9F6-DESAN-R2, 130p (05/1970).
Availability: AD-870 913
NTIS

Light activated silicon switches (LASS) were fabricated and devices tested in a flexible test modulator built specifically for LASS testing. Various types of light triggering were investigated including radiation from GaAs laser diode, xenon flash lamp, incandescent lamp and Q-switched neodymium (Nd³⁺) laser. Devices were fired singly and in series at pulse currents of 500 amperes and d/dt's of 1000 amperes/microsecond using GaAs laser diodes as light trigger. Using the Q-switched Nd³⁺ laser resulted in extremely high speed device turn-on with forward voltage transient over in 20 nanoseconds. A redesign of the early prototype encapsulation was necessary to achieve large pulse current capability. (Author)

Primary Keywords: Electronic Switches; Excitation; Light Pulses; Modulators; Xenon Lamps; Diodes(Semiconductor); Gallium Arsenides; Lasers; Encapsulation; Trigger Circuits

Secondary Keywords: Silicon Switches; Light Activated Devices

5581
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

DEVELOPMENT OF SOLID AND/OR LIQUID-METAL COLLECTORS FOR ACYCLIC MACHINES
R.L. Rhodenizer
General Electric Co., Schenectady, NY 12381
GE Report No. GE-E-71-1110 (09/1971).
Availability: AD-A088334
NTIS

The development of a high-performance liquid-metal collector configuration for operation in high-intensity ambient magnetic fields is discussed. The influence of various design alternatives on collector performance is considered and a collector configuration is specified for further study in an experimental program. The results of a test program confirming the performance characteristics predicted in the theoretical studies is described. The development of liquid-metal collector systems for use in superconductive acyclic machines having multiple-disk rotor arrangements is presented. The characteristics of multiple-disk acyclic machines are reviewed and design factors for high-power-capacity machinery are developed. The results of tests on 150-milliwatt generators are presented. The experiments correlated well with the theoretical predictions and the results of this program will permit the development of large superconductive direct-current machines with efficiencies of over 96 percent. 3 Refs.

Primary Keywords: Liquid Contact; High Intensity Magnetic Field; Performance Test; Experiment; Theory

5582
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)
ELECTRICAL MEASUREMENT OF HIGH VOLTAGE PULSES IN DIAGNOSTIC X-RAY UNITS
R.E. Habner Jr.
National Bureau of Standards, Washington, DC
Interim rept. May 74-Sub 75 No. NBSIR-75-775, 62p (11/1975).
Availability: PB-248 684/3ST
NTIS

The report describes a method of calibrating dividers used to measure high voltage pulses in diagnostic x-ray units. The experimental development emphasized four areas. These were the divider ratio under direct voltage, the frequency dependence of the ratio, the voltage dependence of the ratio and the effect of self-heating on the device. The results of measurements on approximately fifteen different dividers are summarized. In addition, this report contains two appendices. The first discusses conventional and electro-optical methods of measuring the high voltage pulses, while the second presents a more detailed analysis of the feasibility of electro-optical measurement of these pulses.

Primary Keywords: X-Ray Apparatus; Electrical Measurement; High Voltage; Diagnosis; Medical Equipment; Electrooptics; Kerr Electrophysical Effect; Pulsation

Secondary Keywords: Diagnostic Equipment; NTISCOMMBS; NTISFDABRH

5583
(SWITCHES, OPENING)
(Superconductivity)

EXPERIMENTAL RESULTS WITH SC/NC BREAKERS
W. Amend, M. Pillsticker and M. Soel
Institut für Plasmaphysik, Garching, FRG
No. IPP-4/128, 51p (01/1975).
Availability: N76-22465/85T
NTIS

The switching-off effect of a superconductive/normal conductive (SC/NC)-breaker is based on the increase of the resistance from 0 to a determined value, if the transition from the superconductive to the normal conductive state is triggered. The fast commutation of a current from one branch of a network to another can be started by the switching-off effect of a SC/NC-breaker. Results of several tests with SC/NC-breakers suitable for high currents up to 800 A are reported. The relation between the switching time or the commutation time and the rise time of the trigger current pulse, the energy of the pulse, the direct current of the breaker before triggering and a few other electrical parameters are determined experimentally. The demonstration that during commutation an intrusion of electrical energy from the trigger-pulse-circuit into the main circuit never can be compensated completely is an important result of the measurements. (Author)

Primary Keywords: Circuit Breakers; Superconductors; Switching Circuits; Electrical Resistance; Network Analysis; Niobium; Titanium; Trigger Circuits; Wire

Secondary Keywords: West Germany; NTISNAE

5585
(SWITCHES, CLOSING)
(Systems)

HERTZIAN ARRAY SWITCH INVESTIGATION
J.M. Froud, D.H. Baird and W.H. McNeill
GTE Labs Inc., Waltham, MA 02154
RADC Report No. RADC-TR-76-301 (10/1976).
Availability: RADC-TR-76-301
NTIS

An investigation of fast, high power switching with jitter in the subnanosecond time domain is reported. Methods involving field distortion triggering in high pressure gases, photoconduction triggering in aprotic liquids and opto-electronic triggered in solid semiconductors have been investigated. The most promising avenue for further research is identified in the latter area where extremely small jitter and rapid turn-on capabilities are well matched to the timing requirements in Hertzian arrays. 20 Refs.

Primary Keywords: Hertzian Array; Spark Gap; Field Distortion Triggering; Photoconduction Triggering; Subnanosecond Jitter; Gas Gap; Aprotic Liquid Gap

**5588
(POWER TRANSMISSION)**

(Cables)
HIGH VOLTAGE CABLE SPLICING AND CABLE TERMINATION TECHNIQUES
D.E. Meers
Naval Civil Engineering Lab., Port Hueneme, CA
Final rept. Jul 74-Dec 75 No. CCL-TN-1452, 22p (08/1976).
Availability: AD-A030 672/6ST
NTIS

The splicing and termination of underground electrical distribution cable requires that the integrity of cable conductor and insulation be maintained throughout its length. A large number of commercial cable splice and termination kits are available which are claimed to fulfill these requirements. The Civil Engineering Laboratory (CEL) was requested to investigate the suitability of these kits for use at Naval shore facilities. Of special interest were the slip-on cable splice and cable termination for solid dielectric insulated cable. These slip-on devices proved to be the easiest and fastest to install with good reproducibility, and the electrical characteristics were as good as, or better than, the other types of cable splice and cable termination kits tested. (Author)

Primary Keywords: Electric Cable Splices; Electric Terminations; Underground Equipment; Underground Cables; Couplings; Electric Power Distribution; High Voltage; Electric Power; Commercial Equipment; Kits; Dielectric Properties; Electrical Insulation

Secondary Keywords: NTISDDXA

**5590
(ENERGY STORAGE, MECHANICAL)**

(Rotating Machines)
MECHANICAL TANGENTIAL STRESSES IN THE ROTOR DISC OF THE SHOCK-EXCITED HOMOPOLAR GENERATOR AT ITS BRAKING

Y.V. Spichenko
Nauchno-Issledovatel'skij Inst. Elektrofizicheskoy Apparatury,
Leningrad (USSR)
Availability: NP-20375
NTIS

Formulas for determining the mechanical tangential stresses in the rotor disc of the homopolar generator with a liquid-metal circular contact at braking in shock-excited conditions are obtained. The particular cases are considered: a constant thickness disc and a conical one.

Primary Keywords: Electric Generators_Rotors; Rotors_Stresses; Brakes; Liquid Metals; Stress Analysis

Secondary Keywords: ERDA/420200; NTISERDA

Distribution Restriction: U.S. Sales Only.

**5591
(SWITCHES, CLOSING)**

(Gas Gaps, Electrical)
MULTICHANNEL SPARK-GAP TECHNOLOGY FOR STAGED THETA-PINCH MACHINES
W.H. Borkenhagen, R.F. Gribble, L.D. Hansborough, R.K. Linford and J.G. Malton
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-751125-4B, 5p (08/1976).
Availability: LA-UR-75-2152
NTIS

Triggered multichannel switches operating at voltages up to 180 kV with inductances of 10 to 15 nH have been developed for the staged theta-pinch machines at LASL. These multichannel devices, depending upon their design, can switch up to 30 kJ per switch with peak currents up to 1 MA. The designs of the various spark-gap configurations are discussed from a mechanical and an electrical viewpoint. The switching modes including crowbar, high-voltage start, and high-voltage holdoff_low-voltage start, as well as the experimentally determined triggering characteristics, are also discussed.

Primary Keywords: Linear Theta Pinch Devices_Switches; Power Supplies_Spark Gaps; Design

Secondary Keywords: NTISERDA

**5592
H/SUB 2-SF/SUB 6/ GAS MIXTURE AS INSULATION MATERIAL FOR HIGH VOLTAGE TECHNOLOGY**

M. Ermel
(01/1975).
Availability: DRNL-tr-4182
NTIS

Breakdown strength in the uniform and nonuniform field, vapor pressure curves and chemical stability under spark discharges are examined. Moreover, considerations are made to the theory of breakdown in gas mixtures. The investigation of breakdown characteristics leads to a general statement about the electric strength of the N sub 2 -SF sub 6 mixture. Even an important reduction of SF sub 6 content causes only low loss of strength compared to SF sub 6, at the same time preventing SF sub 6 condensation in a wider range. Altogether the mixture shows some advantages compared to SF sub 6. The results of the theoretical considerations modified ionization coefficients for gas mixtures are introduced and explained for the N sub 2 -SF sub 6 mixture. (ERA citation: 01-025717)

Primary Keywords: HVAC Systems; Nitrogen; Sulfur Fluorides; Breakdown; Dielectric Properties; Electrical Insulation; Gas-insulated Cables; Gases; Mixtures
Secondary Keywords: ERDA/200301; Translations; West Germany;
Dielectric Breakdown; NTISERDA

Distribution Restriction: TRANSLATED BY E.G. SILVER FROM INSULATION MATERIAL FOR HIGH VOLTAGE TECHNOLOGY,
ELEKTROTECH. Z., A 96 HS P231-235 1975

**5593
(PARTICLE BEAMS, ELECTRON)**

(Transport)
ON THE PROPAGATION OF HIGH INTENSITY, HIGH VOLTAGE ELECTRON BEAMS AND THE MAXIMUM CURRENT WHICH SUCH BEAMS MAY POSSESS

T.G. Roberts
Army Missile Command, Redstone Arsenal, AL 35809
Technical rept. No. RR-TR-69-7, 27p (06/1969).
Availability: AD-B57 607/6ST
NTIS

The existing theories for the propagation of intense electron beams at relativistic energies and the experimental results so far obtained are reviewed. A phenomenological description of beam propagation is given and an expression for the maximum current that a beam may possess is derived. This expression is somewhat different from the Alfvén limit but reduces to this limit in the case of a fully neutralized beam. (Author)

Primary Keywords: Electron Beams_Propagation; Relativity Theory; Electric Currents; Drift; Focusing; Cosmic Rays

Secondary Keywords: NTISDDXA

Distribution Restriction: Distribution limitation now removed.

**5594
(SWITCHES, CLOSING)**

(Reviews)
R AND D RECOMMENDATIONS FOR FUTURE ERDA SWITCH REQUIREMENTS
D.S. Zucker
Lawrence Livermore Lab., Livermore, CA 94550
No. CONF-760334-2, 8p (06/1976).
Availability: UCRL-7812
NTIS

The following switches are briefly discussed: (1) high pressure and vacuum spark gaps; (2) liquid dielectric gaps; (3) solid dielectrics; (4) nonlinear ferromagnetic materials; (5) semiconductors; superconductors; (6) ferroelectric switches; (7) exploding wires; and (8) plasma instabilities. (ERA citation: 01-018359)

Primary Keywords: Switches; Dielectric Materials; Planning; Power Supplies; Research Programs; Spark Gaps; Thermonuclear Reactors

Secondary Keywords: ERDA/700209; NTISERDA

**5597
(ELECTROMAGNETIC COMPATIBILITY)**

(Transient Suppressors)
TEST PROCEDURES FOR EVALUATING TERMINAL PROTECTION DEVICES USED IN EMP APPLICATIONS

R.L.J. Williams
Harry Diamond Lab., Washington, DC 20438
Technical rept. No. HDL-TR-7709, 84p (06/1975).
Availability: AD-A019 098/5T
NTIS

Certain commercially available components were tested to establish test procedures for characterizing terminal protection devices used in electromagnetic-pulse (EMP) applications. The devices tested include spark gaps, filters, avalanche diodes, and various other nonlinear components. Square pulses of 50- and 500-nsec duration and up to 11 kV in amplitude, with rise times of 2 to 4 nsec, were applied to the devices. Response time and energy leakage were recorded for each test. Insertion loss and approximate failure level were measured for each device. Results are presented in tabular form. The devices that appear suitable for terminal protection include spark gaps, some filters, and some semiconductor devices with breakdown voltage less than about 50.

Primary Keywords: Suppressors; Electromagnetic Pulses; Surges; Transients; Spark Gaps; Electromagnetic Wave Filters; Semiconductor Devices; Test Methods; Electronic Equipment; Protection

Secondary Keywords: Terminal Protection Devices; NTISDDA

**5601
(PARTICLE BEAM, ION)**

(Generation)
BEAM OPTICS FOR ION EXTRACTION WITH A HIGH-VOLTAGE-RATIO ACCELERATION-DECELERATION SYSTEM

T.S. Green
Culham Lab., Abingdon, Oxfordshire, UK
Journal of Physics D: Applied Physics, Vol. 9, No. 7, pp 1165-1171 (05/1976).
7 Refs.

Primary Keywords: Ion Beam Permeance; Two Stage Extraction; Beam Optics; Multiple-Lens Model; Zero Divergence Beam; Beam Magnification

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**5602
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE)**

(Rotating Machines; Systems)
ANALYSIS OF HOMOPOLAR GENERATORS AND SUPERCONDUCTING INDUCTIVE ENERGY STORAGE SYSTEMS AS POWER SUPPLIES FOR HIGH-ENERGY, SPACE-BASED LASERS
J.S. Gilbert and E.A. Kern
Los Alamos National Labs, Los Alamos, NM 87545
(02/1975).

Availability: LA-5837-MS
NTIS

For abstract, see ERA 75 02, number 00231.

Primary Keywords: Energy Storage_Electric Generators; Flywheels; Induction; Lasers; Power Supplies; Superconducting Magnets

Secondary Keywords: ERDA/250100; NTISERDA

**5603
(BREAKDOWN STUDIES)**

(Gas, Electrical)
BREAKDOWN AND PLASMA FORMATION IN A ROTATING PLASMA DEVICE
B. Bonnevier and A.H. Sillesen
Royal Institute of Technology, Stockholm, Sweden
No. TRITA-EPP-74-06, 17p (03/1974).
Availability: W74-26196/7

NTIS

Breakdown and formation of a plasma with high ion temperature were studied in the Puffatron at Risø. The conditions for plasma formation are along the same lines as breakdown in an ordinary crossed field discharge such as Penning, PIG, or magnetron discharge, where ions are not magnetically confined, as in the present experiment. The growth of ionization occurs much faster than expected from ionization by thermal electrons. This has been seen in some earlier rotating plasma experiments. It is suggested that work along the present lines can result in a time independent arc discharge, where ions have thermonuclear energies.)

Primary Keywords: Arc Discharges; Critical Velocity; Crossed Fields; Plasma Heating; Thermonuclear Power Generation; Direct Power Generators; Energy Conversion; Energy Transfer; High Voltages; Ion Motion; Ionization; Magnetically Trapped Particles; Plasma Control

Secondary Keywords: NTISHASA

5604
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)

CASTING COPPER TO TUNGSTEN FOR HIGH POWER ARC LAMP CATHODES

H.A. Will
Lewis Research Center, Cleveland, OH

No. NASA-TM-X-655, 11p (08/1973).

Availability: NTIS 27451/6

NTIS

A method for making 400-kW arc lamp cathodes is described. The cathodes are made by casting a 1.75-in. diameter copper body onto a thoriated tungsten insert. The addition of 0.5-percent nickel to the copper prevents voids from forming at the copper-tungsten interface. Cathodes made by this process have withstood more than 110 hours of operation in a 400-kW arc lamp. (Author)

Primary Keywords: Arc Lamps; Cathodes; Copper Alloys; Refractory Metal Alloys; Tungsten Alloys; Equipment Specifications; Manufacturing; Product Development; Service Life

Secondary Keywords: NASA

5605
(ELECTROMAGNETIC COMPATIBILITY)

(Transient Suppressors)

CHARACTERIZATION OF EMP PROTECTION DEVICES

G.G. Davidson and E.T. Hunter

ECOM, Fort Monmouth, NJ 07703

Technical rept. No. ECOM-4128, 53p (07/1973).

Availability: AD-763 886

NTIS

Since late 1969, a technique based on time domain reflectometry (TDR) to measure the fast switching and shunting capability of EMP protective devices has been used. This technique allows the devices to be characterized in their actual working condition--inserted in the cable line--without the perturbing influence of voltage and current probes. The report starts with the basic line theory and develops an understanding of the effect of shunt devices and the measurement of such effects using TDR. This section is fairly lengthy; however, a good background is essential for the understanding of measurement methods with this technique. In addition to the measurement technique itself, a special pulse generator was developed to provide the necessary pulse into 50 ohm lines. This pulse source is described along with the basic measurement procedure. Specific techniques and data are shown for a variety of shunt protective devices. (Author)

Primary Keywords: Suppressors; Electromagnetic Pulses; Switching Circuits; Nuclear Explosions; Avalanche Diodes; Silicon Controlled Rectifiers; Electric Discharges; Neon; Measurement

Secondary Keywords: Bypasses; Spark Gaps; A

5609
(ENERGY STORAGE; CAPACITIVE; SWITCHES, CLOSING)

(Capacitor Banks; Gas Gaps, Electrical)

CONTROL OF HIGH ENERGY CAPACITOR BANKS

M. Sugира, N. Ikeda, M. Iguchi and S. Takeda

Electrotechnical Lab., Tokyo, Japan

No. RJ-713, 116p (01/1971).

Availability: NTZ-13200

NTIS

Primary Keywords: Capacitors; Electric Equipment; Electrical Properties; Trigger Circuits; Electric Equipment Tests; Equipment Specifications; Spark Gaps

5611
DESIGN AND CONSTRUCTION OF A SPARK GAP ASSEMBLY AND ASSOCIATED CIRCUITS

L. Hubbeling

CERN, Geneva, Switzerland

(04/1972).

Availability: CERN-72-6

NTIS

For abstract, see NSA 26 18, number 43103.

Primary Keywords: Pulse Generators; ELECTRONICS; Radiation Detectors/Spark Chamber

Distribution Restriction: U. S. SALES ONLY

5612
(INSULATION, MATERIAL)
(
EFFECTS OF COATING AND CLEANING ON CORONA AND HIGH-VOLTAGE BREAKDOWN IN ELECTRONIC ASSEMBLIES

E.R. Brown
Bendix Corp, Kansas City, MO
(02/1975).

Availability: BDX-613-1181(Rev.)

NTIS

For abstract, see NSA 31 10, number 28928.

Primary Keywords: Dielectric Materials; Protective Coatings; Corona Discharge; Protective Coatings; Cleaning; Failures; Surface Contamination

Secondary Keywords: NTISERDA

5614
(BREAKDOWN STUDIES)

(Gas, Electrical)

ELECTRICAL AND PHOTOGRAPHIC CHARACTERIZATION OF LOW-INTENSITY CAPACITOR SPARK DISCHARGES

C.R. Westgate, H.S. Kirshenbaum and B.D. Pollock

Picatinny Arsenal, Dover, NJ

Technical rept. No. PA-TR-4737, 36p (02/1975).

Availability: AD-A008 356/85T

NTIS

Some properties of the gaseous discharges normally used in electrostatic initiation of primary explosives are determined from electrical and photographic studies. It is shown that the magnitude of the postbreakdown current can determine the form of the discharge. For currents larger than about 0.3 amp, the discharge is essentially an arc characterized by a low (15-30 v) voltage drop across the gap. For currents less than 0.1 amp, the discharge is essentially a spark or glow discharge characterized by a voltage drop of approximately 300 volts across the gap. In both cases, the voltages and the transition current are only slightly affected by variations in the gas length.

Primary Keywords: Explosives; Electric Ignition; Spark Ignition; Electrostatic Charge; Electric Igniters; Spark Gaps; Glow Discharges; Photographic Analysis

Secondary Keywords: NTISODDA

5616
(ELECTROMAGNETIC COMPATIBILITY)

(Lightning)

FAA LIGHTNING PROTECTION STUDY: LIGHTNING PROTECTION DEVICES

C. Chan

RADC, Griffiss AFB, NY 13468

Final rept. Nov 22-31 Jan 74 (04/1974).

Availability: AD-781 319/9

NTIS

The purpose of the Lightning Protection Study is to determine the degree of susceptibility of the Federal Aviation Administration electronic systems to induced electromagnetic pulse effects due to lightning, and to propose protective devices adequate for low voltage electronic systems. This report covers one phase of the study: the lightning protective devices. The other study phases are reported in separate reports, namely lightning simulation tests of communication cables, analytical study of cable coupling, cable-terminal equipment susceptibility levels. The report consists of five chapters on introductory remarks and breakdown diodes, metal-oxide varistors, and deployment and retrofit of protective devices. (Author)

Primary Keywords: Lightning Arresters; Communication Equipment; Electronic Equipment; Air Traffic Control Systems; Protective Equipment; Gas Discharges; Avalanche Diodes; Semiconductor Devices; Transients; Suppression

Secondary Keywords: NTISDOT; Varistors; Spark Gaps; NTISODDFAA

5619
(PARTICLE BEAMS, ION)

(Generation)

HIGH POWER ELECTROSTATIC ION ACCELERATORS

S.J. Humphries

Cornell University, Ithaca, NY 14850

(10/1973).

Availability: LPS-136

NTIS

For abstract, see NSA 29 05, number 10806.

Primary Keywords: Electrostatic Accelerators; Operation; Field Emission; Ion Beams; Ion Sources; Kev Range 100-1000; Kilo Amp Beam Currents; Mev Range 01-10; Planning; Plasma

Secondary Keywords: AEC

5620
(PULSE GENERATORS; SWITCHES, CLOSING)

(Line Type: Thyristors)

HIGH POWER MODULATOR TECHNIQUES (SCR)

R.A. Smith

Westinghouse Electric Corp, Baltimore, MD Surface Div.

Final rept. 20 Nov 67-30 Jul 68 (11/1968).

Availability: AD-745 111

NTIS

Development and test of a 65KV Silicon Controlled Rectifier demonstrates the application of solid state devices and their inherent reliability in high power pulse modulator techniques. The design exploits the high voltage and high current capabilities of the SCR. Eighty devices in series yield a minimum holdoff voltage of 65KV; the test modulator switches pulse currents of 375 amperes although the SCRs have a 1000 ampere minimum peak pulse current capability. The 65KV SCR switch assembly employs a building block concept utilizing ten, 6.5KV SCR switch assemblies. (Author)

Primary Keywords: Modulators; Silicon Controlled Rectifiers; Silicon Controlled Rectifiers; Electronic Switches; Trigger Circuits; Flash Lamps; Xenon; Saturable Reactors; Control Panels

5622
(SWITCHES, OPENING)

(Vacuum Gaps, Electrical)

HIGH-VOLTAGE ARC INTERRUPTION STUDY

A.S.L.D.L. Gilmore

Senders Associates Inc, Nashua, NH

Final rept. Dec 70-Dec 71 (04/1972).

Availability: AD 744 836

NTIS

In 1968 it was observed by the authors that an axial magnetic field applied to a vacuum arc discharge in a coaxial diode was capable of extinguishing the discharge. A control effort was made to develop a high-voltage dc arc interrupter which resulted in a device capable of interrupting 300 amperes at 15 kilovolts. This device has been operated at repetition frequencies of several pulses per second. Over 300 pulses per second have been achieved at low power levels. The turn-on and turn-off times are, respectively, one and two microseconds. The pulse width is variable from about two to several hundred microseconds. Operation at voltages above 15 kilovolts has been prevented, primarily, by anode spots. With improved materials and vacuum techniques and modified geometries, operating voltages for above 15 kv should be possible. One of the uses for the interrupter is expected to be in high-power modulators. (Author)

Primary Keywords: Electric Arcs; Electric Arcs; Arcs; Reduction; Vacuum Apparatus; Magnetic Fields; Plasma Generators

Secondary Keywords: Interrupters

5623
(BREAKDOWN STUDIES)

(Corona)

INVESTIGATION OF CORONA DISCHARGE DEVICES AS ELECTRICAL LOADS FOR EXPERIMENTAL HIGH-VOLTAGE GENERATORS

K.K. Joshi and T.H. Maloney

Systems Research Labs Inc, Dayton, OH

(06/1971).

Availability: AD-748 335

NTIS

The use of the corona discharge mechanism as a means of providing an electrical load for experimental high-voltage low-current dc generators is investigated. The current-voltage characteristics of several corona discharge configurations, such as point-to-plane, coaxial cylindrical, and wire-to-plane, were experimentally obtained and compared with theoretically predicted values. Of all the configurations tested, the wire-to-plane configuration is found to be capable of dissipating the maximum electrical power (nearly 3 KW/m length of wire) and exhibits a wide range of current-voltage characteristics of various pressures, depending largely upon the wire-to-plane spacing. (Author)

Primary Keywords: Generators; Electrical Corona; Direct Current

Secondary Keywords: Loading(Electrical)

Distribution Restriction: Availability: Pub. in IEEE Transactions on Electron Devices, vED18 n12 p163-1166 Dec 71

5624
(PULSE GENERATORS)
(Trigger)
INVESTIGATIONS ON HIGH VOLTAGE PULSERS AND AMPLIFIERS FOR THE EXACT
TIMING OF THE IGNITION OF SPARK DISCHARGERS
M. Pillsticker
Technische Universität, Brunswick (West Germany). Institut für
Hochspannungstechnik.
(12/1971).
Availability: BMFT-FB-K-71-22
NTIS
For abstract, see MSA 26 10, number 20548.
Primary Keywords: Electric Arcs

5625
(BREAKDOWN STUDIES)
(Gas, Recovery)
INVESTIGATIONS ON THE INTERACTION BETWEEN ARCS AND GAS FLOW
K. Zueckler, H. Toeplin, H. Neecke, R. Patzelt and K.P. Rolff
Siemens-Werke, Berlin, FRG
No. BMFT-FB-T-73-09, 75p (07/1973).
Availability: N74-11552/8
NTIS
Model circuit breaker experiments were carried out to investigate the relationship between gas flow and arc behavior in the current zero-region. Synthetic circuits were used for the electrical tests. The optical investigations were carried out by the aid of a schlieren apparatus with a high speed camera. The existence of plasma jets, which carry metal particles from the gap between the contacts, was demonstrated. The behavior of the insulation material in the proximity of the arc was investigated and a suitable test method was worked out. It was possible to improve the mathematical description of the dynamic arc-behavior by a completion of the equation of Mayr. (Author)
Primary Keywords: Circuit Breakers; Electric Arcs; Gas Cooling; High Speed Cameras; Schlieren Photography; Extinguishing; Gas Flow; High Voltages; Metal Particles; Plasma Jets; Quenching (Cooling)
Secondary Keywords: NASA

5630
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
MECHANISM WHICH LEADS TO THE FORMATION OF AN ELECTRIC SPARK AT VERY
HIGH VOLTAGE AND UNDER ULTRA-VACUUM FOR THE MEASUREMENT OF THE DELAY
TIME OF THE DISRUPTION
F. Rohrbach
CERN, Geneva, Switzerland
(10/1971).
Availability: CERN-71-28
NTIS
For abstract, see MSA 26 09, number 22469.
Primary Keywords: Electric Arcs

5631
(PARTICLE BEAMS, ION)
(Generation)
THE USE OF FINITE J/SUB THETA/ FOR INCREASING THE ION EFFICIENCY OF
HIGH IMPEDANCE DIODES
R.J. Barker and S.A. Goldstein
Naval Research Lab., Washington, DC 20375
NRL Memorandum Report No. 4773, 45p (04/1982).
Availability:
NTIS
Numerical simulations predict that the ratio of the effective ion current to total diode current can be significantly increased by introducing a small but finite azimuthal current into the tip of the cathode shank of a high impedance (4 ohm) axial pinch-reflex diode. Such a current generates large tangential magnetic fields along the electron-emitting cathode surfaces. These fields, in turn, impart a finite angular momentum to the electrons as they are injected into the anode-cathode gap. The resultant particle self-fields alter electron trajectories in such a way as to boost electron space charge near certain portions of the ion-emitting anode surface. The net consequence is a modification of the radial profile of ion emission which enhances the net ion current transmitted through the interior of the hollow cathode shank. 31 Refs.
Primary Keywords: Ion Beam Generation; Magnetic Insulation; Pinch-reflex Diode; Theory; Numerical Simulation

5634 PHOTOCONDUCTIVITY OF HIGH-VOLTAGE SPACE INSULATING MATERIALS
H.T. Coffey, J.E. Nanavitz and R.C. Adamo
Stanford Research Institute, Menlo Park, CA 94025
Final Report, 1 Jul. 1974 - 1 Oct. 1975. No. NASA-CR-134995, 67p
(01/1975).
Availability: N75-19233/55T
NTIS
The dark and photoconductivity of four high voltage spacecraft insulators, Kapton-H, FEP Teflon, Parylene, and fused quartz, were studied under a variety of conditions intended to simulate a space environment. All measurements were made in a vacuum of less than .00001 torr while the temperature was varied from 22°C to 100°C. Some of the samples used employed conventional deposited metal electrodes--others employed electrodes composed either of an electron beam or a plasma formed by ionization of the residual gas in the test chamber. Test results show: (1) Kapton had unusual conduction properties; its conductivity decreased by more than an order of magnitude when heated at 100°C in a vacuum, but ultimately attained a stable and reproducible value. (2) Both Teflon and fused quartz had high dark resistivities but low photoresistivities when exposed to UV. Optical-density measurements indicated that both materials transmitted UV with little attenuation. (3) Parylene was found to have a low but relatively stable resistivity--comparatively minor changes occurred upon heating or illuminating the sample. Optical-density measurements showed that Parylene was absorbent in the UV and would prevent photoemission from the metal electrode on the back surface. (Author)
Primary Keywords: Electrical Insulation; Materials Tests; Photoconductivity; Spacecraft; High Voltages; Environment Simulation; Quartz; Teflon (Trademark); Secondary Keywords: Polyimide Resins; Kapton; Tetrafluoroethylene Resins; Parylene Polymers; Poly(methylene-phenylene-methylene); NTIS/NASA

5635
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
PORTABLE KERR SYSTEM FOR THE MEASUREMENT OF HIGH VOLTAGE PULSES
R.E.J. Webber and S.R. Barker
Sandia Laboratories, Albuquerque, NM 87115
No. CONF-750405-1-5p (01/1975).
Availability: SAND-75-5132
NTIS
For abstract, see MSA 31 12, number 35721.
Primary Keywords: Pulses; Measuring Methods; Optical Systems; Kerr Effect; Laser Radiation; Mirrors; Oscillographs; Photodetectors; Polarization; Pulse Rise Time
Secondary Keywords: NTISERDA

5636
(POWER CONDITIONING)
(Pulse Transformers)
POWER PULSE TRANSFORMER
O.S. Bogdanov, Y.P. Vekhrushin, V.G. Zhitenev, M.I. Kolesov and A.V. Orlow
Scientific-Research Institute Of Electro-Physical Apparatus, Leningrad, USSR
Availability: NP-19092
NTIS
For abstract, see MSA 26 05, number 10678.
Primary Keywords: Electron Sources; Linear Accelerators; Transformers

5638
(BREAKDOWN STUDIES)
(Gas, Electrical)
QUANTITATIVE MEASUREMENTS OF THE EMISSION FROM HIGH DENSITY NANOSECOND
SPARK CHANNELS
H.S.W. Fischer
Angewandte Physik, Technische Hochschule Darmstadt, Darmstadt, FRG
Interim Scientific Rept., no. 2, 1 Feb 70-31 Jan 71 (12/1971).
Availability: AD-739 253
NTIS
Quantitative values of the luminance and radiance at 4950 Angstrom were measured for Nanolite spark channels in the nanosecond range. The comparison standard was a crater of a low current carbon arc. Date of the Nanolites were: Capacitance, 1.35 nfenofarads; Inductance, 2.1 microHenrys; Breakdown Voltage, 3.2 kilovolts; Gap, 1.65 mm; Pressure, 1 atmosphere. The maximum luminance was 20.0 watts per centimeter squared steradian Angstrom plus or minus 20 percent. The maximum radiance (at 4950 Angstrom) was 12.6 times tan in the sixth candlepower per centimeter squared, plus or minus 20 percent. Earlier observations demonstrated that the opacity in 1 atmosphere air during the current maximum is greater than 0.8. This opacity value is used to calculate the radiation temperature which was 31000 degrees. The scaling laws are being derived for comparison with earlier observations in literature. These results compare rather well in spite of considerable simplifications used in the calculations. (Author)
Primary Keywords: Electric Discharges; Light Pulses; Luminescence; Gas Discharges; Electric Arcs; Spectra (Visible + Ultraviolet)
Secondary Keywords: Spark Gaps

5640
(SWITCHES, OPENING)
(Superconductive)
SUPERCONDUCTING SWITCH WITH IMPULSE CURRENT TRIGGERING
H. Koefler
Institut für Experimentalphysik, Karlsruhe, FRG
No. KFK-2123, 26p (08/1975).
Availability: M76-25667/65T
NTIS
Supplying reactive power by superconducting storage systems may have considerable advantages. The behavior and parameters of the switching device, and opening and closing the storage circuit were studied. Approximate mathematical solutions were checked against measured results. The influence of the impulse capacitor was studied and hints to design the triggering circuits are given. (Author)
Primary Keywords: Actuators; Superconductors; Switches; Capacitors; Energy Storage; Trigger Circuits
Secondary Keywords: West Germany; NTIS/NASA
Distribution Restriction: In German; English Summary.

5642
(PULSE GENERATORS)
(LC)
DRIVING CIRCUITS FOR COPPER HALIDE LASERS - A PARAMETRIC STUDY
A.J. Andrews, R.C. Tobin and C.E. Webb
Clarendon Lab., Oxford, UK
Journal of Physics D: Applied Physics, Vol 13, No. 6, pp 1017-1027 (06/1980).
13 Refs.
Primary Keywords: Double Spark Gap; Thyratron Burst Mode Drivers; Circuit Inductance; Current Rise-time; Laser Performance
COPYRIGHT: 1980 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**5646
(BREAKDOWN STUDIES)**

**(Gas, Electrical)
INFLUENCE OF STATISTICAL TIME LAGS UPON ELECTRIC BREAKDOWN IN ELECTRONEGATIVE GASES**

R.W. Crowe

Franklin GNO Corp, West Palm Beach, FL

Journal Of Applied Physics, Vol. 37, No. 4, pp 1515-1527 (03/1966).

Measurement of the electric strength of SF₆ and a number of other electronegative gases has provided direct evidence that an unusually long statistical time lag is associated with the breakdown process in such gases under certain experimental conditions. For example, time lags in excess of one minute have been reported for the breakdown of SF₆ at 6 kV. The reason for the difference in breakdown behavior of such gases, when compared with the behavior of the more common gases, is not well understood. The paper represents an attempt to provide an explanation of the role that these statistical time lags can often play in yielding misleading experimental values of the electric breakdown voltage, when measured under certain standard test conditions. A number of cases are discussed and evaluated by combining accurate experimental data with theories involving the occurrence of random events. It is concluded that the 'apparent' value of the electric breakdown voltage in electronegative gases ought to be strongly dependent upon the mean statistical time lag, the nature of voltage application, and the electrode configuration. The experimentally observed appearance of field emission from the cathode surface at voltages considerably in excess of the threshold value, can be used to derive theoretical relationships which indicate that rather significant 'apparent' deviations from Paschen's law are to be expected under certain experimental conditions. 9 Refs.

Primary Keywords: Statistical Time Lag; Electronegative Gas; Several Gases; Breakdown Voltage; Error; Paschen's Law Deviation; Experiment; Theory

COPYRIGHT: 1966 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**5646
(PULSE GENERATORS)**

(Merx)

TRANSIENT PHENOMENA IN THE MARX-TYPE MULTIPLIER CIRCUIT AFTER FIRING THE FIRST SWITCHING SPARK GAP

A. Rodewald

National Research Council, Ottawa, Ontario, Canada

No. NRC-IT-1516, 28p (01/1972).

Availability: NT2-18236

NTIS

The transient processes after the firing of the first switching spark gap in the Marx-type multiplier circuit are investigated experimentally. The test results are described in terms of a simple equivalent diagram. The equivalent diagram comprises a series of resistances with longitudinal and transverse capacitance. The series of resistances is formed by the resistances inserted between the individual generator stages. The so-called discharge resistances here play the principal part. The longitudinal and transverse capacitances in the circuit are provided by the stray capacitances between neighbouring generator stages and the stray capacitances of the generator stages relative to earth. The generally capacitive loading of the generator in the case of the observed rapid transient processes acts as a short circuit at the output of the series. The longitudinal voltages in the individual states of the series appear as overvoltages at the corresponding switching spark gaps. The firing of a switching spark gap as the result of such an over voltage is oscillographed. (Author)

Primary Keywords: Multiplexing; Spark Gaps; Transient Response; Circuit Diagrams; Electric Potential; Fire Control Circuits

**5647
(BREAKDOWN STUDIES)**

(Equipment)

TRANSPORT PROPERTIES IN HIGH POWER ARCS

H.H. Maeker, Technische Universität München (West Germany) Elektrophysikalisches Institut

Final rept. 1 Feb 67-31 Jan 71 (05/1972).

Availability: AD-744 518

NTIS

In order to investigate transport and radiation properties of various plasmas the cascade arc chamber was improved with respect to new electrodes, to pressure proof, and to air-cooled plates for low power input and was made fit for viscosity measurements by providing a honeycomb flow classifier and pressure taps along the cascade. The temperature distribution across the H₂-arc has been reexamined by all methods available with high precision. The splitting of the heat flux vs. radial curves vs. temperature at low currents in the H₂ arc could be removed by reducing the electron temperature to the gas temperature taking into account inelastic collisions between electrons and H₂-molecules. In the Ar/arc radiation plays a dominant role and changes rapidly with elevated pressures. Therefore extended measurements of all quantities of interest have been carried out at temperatures up to 25,000K and in the pressure range from 1 to 10 atm.

Primary Keywords: Gas Discharges; Transport Properties; Gas Ionization; Laminar Flow; Hydrogen; Oxygen; Nitrogen; Electrical Conductance; Thermal Conductivity; West Germany

Secondary Keywords: Plasma Diagnostics; Electron Energy; Hydrogen Plasma; Nitrogen Plasma; Argon Plasma

**5648
(SWITCHES, CLOSING; SWITCHES, OPENING)**

(Vacuum Tubes; Vacuum Tubes)

TUBE FAILURE MECHANISMS

K.G. Beuchard and L.N.P. Lesensky

Raytheon Co, Waltham, MA

Final rept. 1 May 68-30 Sep 69 No. PT-2517, 98p (03/1970).

Availability: AD-869 174

NTIS

The investigation focused attention on (1) high voltage breakdown in vacuum as it occurs across vacuum gaps and along insulating surfaces and (2) surface studies of metal-oxide composite cathodes, as exemplified by the tungsten-thoria (W-ThO₂) cermet cathode, pertaining to the chemical and topographical changes resulting from heat and electron bombardment. (Author)

Primary Keywords: Electronic Tubes; Future(Electronics); Cathodes(Electron Tubes); Cerments; Copper; Surface Properties; Electric Discharges; Diffusion; Platinum; Tungsten; Titanium Alloys

Secondary Keywords: High Voltage Breakdown

**5649
(PULSE GENERATORS)**

(Blumlein, Line)

ELECTRICAL AND OPTICAL CHARACTERISTICS OF A MULTICHANNEL N/SUB 2/-LASER

M. Hugenschmidt and J. Hey

Deutsch-Französisches Forschungsinstitut, Saint Louis, France

Optics Communications, Vol. 29, No. 2, pp 191-196 (05/1979).

The influence of electrical parameters on the optical properties of atmospheric pressure transversely excited N₂/sub 2/-lasers of the Blumlein-type is investigated. Experiments are performed using a multichannel laser system providing high repetition rate trains of nanosecond pulses (50 to 100 MHz). Both the high voltage rise and decay times of the order of several kV/ns are determined electro-optically and correlated with the intensity and time lag of the optical pulses. Using an injection technique the intensity and beam divergence could be markedly improved. 16 Refs.

Primary Keywords: Blumlein Type Multichannel N₂/sub 2/-Laser;

Electrical Properties; Optical Properties;

Transversal Excitation

COPYRIGHT: 1979 NORTH HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

**5651
(BREAKDOWN STUDIES)**

(Vacuum, Electrical)

CALIBRATION OF A FAR ULTRAVIOLET SPECTROGRAPH AND A STUDY OF VACUUM SPARK BREAKDOWN

T.M. Carpenter

Oklahoma State University, Stillwater, OK

No. NASA-CR-102643, 120p (05/1970).

Availability: NTD-26046

NTIS

Primary Keywords: Aluminum; Far Ultraviolet Radiation; Spark Gaps; Spectrometers; Emission Spectra; Plasma Temperature; Ruby Lasers; Spectrum Analysis

**5652
(DIAGNOSTICS AND INSTRUMENTATION)**

(Voltage)

CALIBRATION OF A KERR CELL SYSTEM FOR HIGH VOLTAGE PULSE MEASUREMENTS

E.C. Cassidy and H.M. Cones

Sandia Labs, Albuquerque, NM 87115

Final rept. No. SC-CR-68-3730, 53p (08/1968).

Availability: PB-180 864

NTIS

The report summarizes progress made on the Kerr cell pulse measurements project. The following are included: (1) Systems for purification and testing of the nitrobenzenes used in our Kerr cells were developed. (2) Methods for calibration of a Kerr system by reference to calibrated pulse divider measurements. These calibrations are believed to be accurate to better than 1%. (3) Methods for independent (without reference to pulse divider measurements), under both uniform and nonuniform field conditions, were developed and evaluated. (4) Pulse voltages as high as 100 kV were measured (simultaneously), by use of a calibrated pulse divider and a Kerr system. Seven different Kerr cells were used. With further refinements, it is anticipated that such calibrations, accurate to within plus or minus 0.5%, will be feasible for systems capable of time-resolved measurements of pulses as high as 300 kV.

Primary Keywords: Shutters(Optics); Kerr Cells; Kerr Cells Calibration; Electrostatic Fields; Birefringence; Polarization; Nitrobenzenes; Optical Equipment; Design; Pulse Systems; Lasers

**5653
(ENERGY STORAGE, CAPACITIVE)**

(Capacitor Banks)

CAPACITOR BANKS FOR A TURBULENCE HEATING EXPERIMENT

G. Herppich, A. Knobloch and G. Mueller

Institut für Plasmaphysik, Garching, FRG

No. IPP-4/50, 44p (06/1968).

Availability: N68-32301

NTIS

Primary Keywords: Capacitors; Electric Energy Storage; Turbulent Heat Transfer; Electric Potential; Ignition; Inductors; Ionization; Spark Gaps; Suppressors; Theta Pinch

**5655
(SWITCHES, CLOSING; SWITCHES, CLOSING)**

(Systems; Gas Gaps, Electrical)

CROWBAR SYSTEM IN ISAR 1

E. Van Mark and H. Wedler

Institut für Plasmaphysik, Garching, FRG

No. IPP-4/59, 29p (06/1968).

Availability: N68-32534

NTIS

Primary Keywords: Capacitors; Plasma Generators; Spark Gaps; Arc Generators; Electric Discharges; Magnetic Fields; Short Circuits; Systems Engineering; Trigatrons

**5656
(POWER CONDITIONING)**

(Cable Terminations)

DAMPING OF VOLTAGE REFLECTIONS AT OPEN CIRCUIT ENDS OF CHARGED CABLES

H.-J. Schneider-muntau

European Space Research Inst, Frascati, Italy

(01/1969).

Availability: N69-35146

NTIS

Primary Keywords: Capacitance; Electric Pulses; High Voltages; Transmission Lines; Damping; Electrical Resistance; Numerical Analysis; Reflected Waves

5657
(BREAKDOWN STUDIES)
(Vacuum; Electrical)

DESIGN AND ANALYSIS OF A STATISTICAL EXPERIMENT ON HIGH VOLTAGE BREAKDOWN IN VACUUM

M.M. Chrenta, M.H. Zinn and G.W. Taylor
ECOM, Fort Monmouth, NJ 07703
Technical rept. No. ECOM-2939, 19p (02/1968).
Availability: AD-668 241
NTIS

The results of an experiment designed as a quarter replicate of a 2 to the 7th power plan on factors affecting high-voltage breakdown in vacuum are given. The significance of each of the seven factors is analyzed, showing the effect of electrode materials, electrode geometry, electrode finishes, and the breakdown process. A good degree of confidence was obtained showing that the anode material and anode geometry are important in the cause for breakdown. The results of these statistically designed experiments and other experiments performed investigating the activity in high-voltage gaps lead to the conclusion that anode effects play a major role in the breakdown process. Upon completion of this full line of designed experiments, the information gained from this work will be compiled in charts and graphs as a design monograph for the high-voltage high vacuum component design engineer. (Author)

Primary Keywords: Failure(Electronics); Vacuum; Voltage; Statistical Analysis; Radar Equipment; Design; Ion Accelerators; Space Propulsion; Particle Accelerators; Test Methods; Electrodes; Geometry; Materials; Anodes; Cathodes

Secondary Keywords: Graphs(Charts)

5658
(BREAKDOWN STUDIES)
(Gas; Electrical)

EFFEKT OF ATMOSPHERIC HUMIDITY ON BREAKDOWN VOLTAGE OF VARIOUS SPARKOVER LENGTHS AT VARIOUS VOLTAGE FORMS

M.S. Guindeli
 Eidgenössische Technische Hochschule, Zurich, Switzerland
 Einfluss Der Luftfeuchtigkeit Auf Die Durchbruchsspannung Verschiedener Funkenstrecken Bei Verschiedenen Spannungsformen No. DISS-4347, 140p (02/1968).

Availability: NTB-38345
NTIS

Primary Keywords: Atmospheric Moisture; Electrical Faults; Spark Gaps; Electric Potential; Flashover

5659
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum; Electrical; Electrodes)

ELECTRICAL BREAKDOWN BETWEEN ERBIUM OXIDE, ERBIUM DEUTERIDE, AND POLYBODENUM ELECTRODES IN A VACUUM

M.H. Davies, W.D. Owen and W.D. Powell
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
No. AWRE-O-1/69, 32p (02/1969).
Availability: NS9-34178
NTIS

Primary Keywords: Electrical Faults; Electrodes; Erbium Compounds; Polyytobdenum; Vacuum; Deuterides; Oxides; Spark Gaps

5661
(SWITCHES; CLOSING)
(Vacuum Gaps; Electrical)

FIRING CHARACTERISTICS OF MULTIPLE-ELECTRODE TRIGGERED VACUUM GAPS

S.B.A.J. Schneider and J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. ECOM-3025, 15p (10/1968).
Availability: AD-677 381
NTIS

The design of a multiple-electrode triggered vacuum gap for 350-kilovolt operation as an energy diverter was described at the Ninth Modulator Symposium. This program was continued. In the design of the new tubes, the primary design objective was to achieve minimum firing time and without excessive voltage hold-off for reliability. The arc length was considerably shortened and the ceramic sidewalls have been shielded from the arc. Three different designs were constructed. They are a six-gap tube, a three-gap tube, and a modified version of the three-gap tube with a hydrogen reservoir added. The firing characteristics of these tubes were studied from 1 kilovolt to 280 kilovolts. The influence of a low pressure of hydrogen on firing and hold-off was evaluated. (Author)

Primary Keywords: Discharge Tubes; Trigger Circuits; Electrodes; Design; Electric Arcs; Plasma Medium; Energy Management

5662
(BREAKDOWN STUDIES)
(Equipment)

FURTHER DEVELOPMENT OF THE CASCADE HIGH POWER ARC CHAMBER

H. Meeker and S. Steinberger
Culham Translations Office, UK
No. CTO-477, 12p (02/1968).
Trans. From: Z. Angew. Phys. No. 6, pp 456-458 (1967)
Availability: NS8-30378
NTIS

Primary Keywords: Arc Chambers; Plasma Cylinders; Copper; Electrical Insulation; Electrodes; Electromagnetic Fields; Heat Transfer; High Voltages; Silicon; Thermal Insulation

5663
(PULSE GENERATORS)
(Capacitor Banks)

GENERATION OF RAPID RISE CURRENT PULSES IN THE MSEC RANGE FOR FAST COMPRESSION EXPERIMENTS

G. Herrschich and A. Knoblich
Institut für Plasmaphysik, Garching, FRG
No. IPP-4/57, 48p (06/1968).
Availability: NS8-32280
NTIS

Primary Keywords: Analysis (Mathematics); Electric Energy Storage; Inductance; Pulse Generators; Shock Heating; Capacitors; Conferences; Costs; Electric Current; Electric Discharges; Magnetic Diffusion; Magnetohydrodynamic Generators; Plasma Generators

5666
(SWITCHES; CLOSING)
(Gas Gaps; Solid)

INHOMOGENEOUS AIR SPARK GAPS AT DIFFERENT VOLTAGE LOAD

K. Fesser
Technische Hochschule München (West Germany), Fakultät für Maschinenwesen Und Elektrotechnik.
Inhomogene Luftfunkenstrecken Bei Verschiedener Spannungsbeanspruchung (06/1968).
Availability: NTB-33687
NTIS

Primary Keywords: Circuit Protection; Electric Potential; Overvoltage; Spark Gaps; Alternating Current; Direct Current; Electric Power Transmission; Surges; Volt-amperes Characteristics

5667
(INSULATION; MATERIAL)
(Solid)

INSULATION STUDIES FOR HIGH POWER TUBES

H.C. McGowan, E.J. Smoke and D.L. Frey
New Jersey Ceramic Research Station, New Brunswick, NJ

Final rept. 27 p. 26 Sep 69 (03/1970).
Availability: AD-707 946
NTIS

A feasibility study of insulation materials for application in high power electron tubes was made. Pertinent properties included: low dielectric constant (< 3.0), low dielectric loss (0.0001), high thermal conductivity (0.5 cal/cm. sec. C). After an extensive literature search, a theoretical study was carried out on the fundamental factors affecting a material's property values. This was extended to include those materials currently available, which most closely approximate the target values. The approaches to determine the feasibility of developing the desired new material centered around three areas: (1) observation of property value ranges for material classes; (2) analysis of property value trends for families of compounds based on the position of their elements in the Periodic Table; (3) synthesis and analysis based on the more promising crystal structures as predicted by band theory. No new materials was found which better approximated the ideal than do BeO and BN. The trends in the data do not give much hope of finding a more ideal new compound. This study concludes that the most feasible approach to a closer approximation of the target values would be the growth and utilization of BN in whisker form. (Author)

Primary Keywords: Electron Tubes; Electric Insulation; Beryllium Oxides; Boron Compounds; Nitrides; Dielectric Properties; Thermal Conductivity; Feasibility Studies

Secondary Keywords: Boron Nitrides

5668
(SWITCHES; CLOSING)

(Miscellaneous Solid State)

INVESTIGATION OF DESIGN OF HIGH VOLTAGE, HIGH CURRENT SOLID STATE SWITCHING DEVICES (FINAL TECHNICAL REPORT)

E.R. Graf
Auburn University, AL
No. NASA-CR-98075, 109p (04/1968).
Availability: NS9-10271
NTIS

Primary Keywords: Rectifiers; Semiconductor Devices; Switching Circuits; Semiconductor Junctions; Surges; Trigger Circuits

5669
(SWITCHES; CLOSING)

(Gas Gaps; Electrical)

INVESTIGATIONS ON LOW-INDUCTIVE SPARK GAPS FOR HIGH VOLTAGES IN AIR

M. Pilitsicker
Technische Universität, Brunswick (West Germany), Institut für Hochspannungstechnik.
(10/1970).
Availability: BMBW-FBK-76-17
NTIS

For abstract, see NSA 25 04, number 07375.

Primary Keywords: Electric Fields

5670
(PULSE GENERATORS)

(Trigger)

MODEL-10 PRECISION DELAY TRIGGER GENERATOR

A.T. Brousseau
Los Alamos National Labs, Los Alamos, NM 87545
(08/1968).
Availability: LA-3964-MS
NTIS

Primary Keywords: Trigger Circuits; Delay Circuits; Plasma Physics

5671
(SWITCHES; CLOSING)

(Vacuum Gaps; Electrical)

INVESTIGATION OF MULTIPLE-ELECTRODE TRIGGERED VACUUM GAPS

S. Schneider, A.J. Buffa and J.E. Creedon
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-16, No. 3, pp 293-296 (03/1969).

Since the design criteria for reliable operation of a single gap at 300 KV are not well known, multiple-electrode triggered vacuum gaps were constructed. A six-gap structure was initially studied. It had excessive time delay in the initiation of the arc. Subsequently, a three-gap structure was built. Time delays in initiation of the arc were satisfactory, but the rate of rise of current was slow. In addition, voltage hold-off capability was marginal. To improve these characteristics, a low pressure of hydrogen, 7 to 25 mTorr, was used. Consequently, reliable triggering characteristics and reliable voltage hold-off at 320 KV were obtained. 8 Revs.

Primary Keywords: 300 KV Operating Voltage; Six-gap Switch; Delay Measurement; Three-gap Switch Short Delay; Slow Current Rise; Gas Fill

COPYRIGHT 1969 IEEE. REPRINTED WITH PERMISSION

- 5672**
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
PRESSURIZED SWITCHING UNIT DESIGNED TO START AND TO CROWBAR A TURBULENCE HEATING EXPERIMENT
G. Klement and G. Mueller
Institut für Plasmaphysik, Garching, FRG
No. IPP-4/52, 37a (06/1968).
Availability: N69-32431 NTIS
- Primary Keywords:** Spark Gaps; Switching Circuits; Trigger Circuits; Aluminum; Bibliographies; Electrodes; Epoxy Resins; Ferrites; Oscillographs; Pressure Chambers; Trigatrons
- 5676**
(ENERGY STORAGE, CAPACITIVE; SAFETY)
(Capacitor Banks)
SAFETY PROBLEMS IN THE JULIETTA CAPACITOR BANK
F.J. Friedrich and A. Lieckfe
Institut für Plasmaphysik, Garching, FRG
No. JUL-540-PP, 18p (06/1968).
Availability: N69-18694 NTIS
- Primary Keywords:** Capacitors; Circuit Protection; High Current; Safety Devices; Capacitance Switches; Electric Energy Storage; Failure; Reactor Safety; Trigatrons
- 5677**
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
SWITCHES FOR HIGH CURRENT DEVICES
R. Wilhelm
Institut für Plasmaphysik, Garching, FRG
Schaltelemente Fuer Stossstromanlagen No. IPP-1/85, 33p (08/1968).
Availability: N69-18790 NTIS
- Primary Keywords:** Electric Switches; High Current; Plasma Physics; Spark Gaps; Electric Pulses; Ferrites; Foils (Materials); Theta Pinch; Vacuum Apparatus
- 5678**
(POWER CONDITIONING)
(Reviews)
TECHNIQUES OF SHAPING HIGH-VOLTAGE NANOSECOND PULSES
G.A. Vovob'yov and S.A. Masyatov
FTD, Wright-Patterson AFB, OH
No. FTD-HC-23-643-78, 168p (03/1971).
Availability: AD-724 793 NTIS
- The monograph is the first attempt at a systematic presentation of material on the techniques of shaping high-voltage nanosecond pulses. A considerable portion of the book is made up of the authors' works started at the high-voltage laboratory of Tomsk Polytechnic Institute in 1957 on the initiative of the Doctor of Physicomathematical Sciences Professor A. A. Vovob'yov. Description of devices for obtaining and converting the high-voltage nanosecond pulses is preceded by an analysis of the basic processes taking place in a spark with account taken of the Heizer and Rompe theories and of the theory of self-sustained discharge and transient processes in a discharge circuit. (Author)
- Primary Keywords:** Pulse Generators; Configuration; Gas Discharges; Voltages; Measurement; USSR
Secondary Keywords: Translations; Nanosecond Pulses
- 5679**
(BREAKDOWN STUDIES)
(Gas, Electrical)
THE DEVELOPMENT OF A LONG SPARK AND LIGHTNING
I.S. Stekolnikov and A.V. Shkilev
FTD, Wright-Patterson AFB, OH
No. FTD-HT-24-66-68, 29p (03/1968).
Trans. From: Radiotekhnicheskii Institut, Moscow Trudy, pp 97-100 (1966)
Availability: AD-775 456 NTIS
- To increase the understanding of the growth process of long sparks, laboratory studies were conducted. In these image-converter tube graphs were constructed using an electron-converter tube with light amplification. To record the discharge current and voltage in the gap, a high speed electronic oscillograph was used. High optical sensitivity permitted a sharp focusing of the weak light fluxes of the initial spark stages. These spark studies were conducted with three different gas arrangements. (Author)
- Primary Keywords:** Electric Discharges; Production; Growth; Sparks; Lightning; Light; Light-Electron Tubes; Photographic Equipment; Image Converters; Electric Currents; Voltage; Oscillographs; Optical Scanning; Test Facilities; USSR
Secondary Keywords: Translations; Coronas; Spark Gaps
- 5680**
(BREAKDOWN STUDIES)
(Liquid, Electrical)
THE IMPULSE BREAKDOWN IN INSULATING OIL
M.O. Kratzenstein
Technische Hochschule München (West Germany). Fakultät für Maschinenwesen Und Elektrotechnik.
Der Stossdurchschlag in Isolieröl (03/1968).
Availability: N69-40758 NTIS
- Primary Keywords:** Electric Discharges; Electrical Faults; Electrical Insulation; High Voltages; Mineral Oils; Electric Field Strength; Electrodes; Voltage Generators
- 5683**
(ENERGY STORAGE, MECHANICAL)
(Reacting Machines)
USE OF THE HOMOPOLAR GENERATOR TO POWER XENON DISCHARGE TUBES AND SOME ASSOCIATED SWITCHING PROBLEMS
E.K. Inall
Australian National University, Canberra, Australia
No. EP-RR-23, 30p (05/1969).
Availability: N71-11368 NTIS
- Primary Keywords:** Electric Equipment; Electric Generators; Electrical Faults; Electric Switches; Equipment Specifications; Failure Analysis; High Voltages
- 5684**
(BREAKDOWN STUDIES)
(Gas, Electrical)
A HIGH-POWER ELECTRIC SPARK IN AIR AT ATMOSPHERIC PRESSURE
I.S. Abramson and I.S. Marshak
American Meteorological Society, Boston, MA
No. T-R-614, 2p (12/1963).
Availability: AD-602 128 NTIS
- Investigation of a spark, energized by a voltage source capable of supplying currents of several hundred amperes for a period of the order of 10 to the minus 8th power sec, showed that the voltage drop on the spark for such currents is considerably greater than the potential difference in a normal arc. By the end of the voltage dip, the diameter of the channel, determined by the Kerr cell, is independent of the current, at least in first approximation. There is a certain critical current density in the spark channel for the given potential difference between the electrodes. The quantity of energy liberated in the spark gap can be very large, owing to saturation. A discharge in metal-vapor vapor is akin to a discharge with high current density in the last stages of the spark. (Author)
- Primary Keywords:** ELECTRICAL DISCHARGES; ENERGY; SPARKS; ELECTRICAL PROPERTIES; ELECTRIC ARCS; VOLTAGE; ELECTRIC CURRENTS; ELECTRODES; GAS IONIZATION; PLASMA PHYSICS; USSR
- 5685**
(PULSE GENERATORS; POWER CONDITIONING)
(Trigger; Saturable Reactors)
A MAGNETO-DYNAMIC TRIGGER
E.V. Bolotov and V.F. Kalyuzhnyi
FTD, Wright-Patterson AFB, OH
(08/1964).
Availability: AD-605 463 NTIS
- A new trigger is proposed containing a magnetic core with three magnetic contours of a material having hysteresis loops in a nearly rectangular position, and characterized by the fact that for the purpose of expanding the limits of the signal switch connection with power output, a 'Kholla' pick-up is placed in the first magnetic contour and, in the magnetic circuit of the other two, are placed toroidal cores on which is wound a commutating winding. (Author)
- Primary Keywords:** MAGNETIC CORES; TRIGGER CIRCUITS; TRIGGERS; CIRCUITS; MAGNETIC CORES; SWITCHING CIRCUITS; MAGNETIC COILS; DESIGN; HYSTERESIS; PATENTS; USSR
- 5686**
(PULSE GENERATORS)
(Trigger)
A 15 KV TRIGGER-GENERATOR WITH SPARK GAP
R.C. Kunze and E.V. Mark
Institut für Plasmaphysik, Garching, FRG
15 Kv Triggergerat Mit Funkenstrecke No. IPP-4/43, 13p (06/1967).
Availability: N67-36499 NTIS
- Primary Keywords:** Kerr Cell; Pulsed Generator; Spark Gap; Cell; Discharge; Fast; Gap; Generator; High Voltage; Jitter; Lifespan; Low Power; Pulse; Rise; Spark; Transient; Trigger
Secondary Keywords: IN GERMAN; English Summary
- 5689**
(PULSE GENERATORS)
(Trigger)
DEVICE FOR TRIGGERING DISCHARGE TUBES IN A HIGH-VOLTAGE PULSE GENERATOR
V.F. Usov
FTD, Wright-Patterson AFB, OH
No. FTD-HT-66-723, 7p (02/1967).
Trans. From: Russian Patent No. 175 085 Availability: AD-655 036 NTIS
- The patent describes a device for triggering discharge tubes in a high-voltage pulse generator containing a generator of triggering pulses, electrodes of an ignition discharge tube, and a section of coaxial cable. For the purpose of preventing the shunting of the resistance of the load of the generator by the ignition circuit and the protection of the generator of the triggering generator from the action of high tension, a section of the coaxial cable over which the triggering pulse is passed to the ignition discharge tube is wound on a core of ferromagnetic material, and the sheath of the cable is grounded from the side of generator of the triggering pulses.
- Primary Keywords:** Pulse Generators; Trigger Circuits; Trigger Circuits; Discharge Tubes; Electrodes; Coaxial Cables; USSR; Patents

5695
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; INSULATION, MATERIAL;
INSULATION, VACUUM)
(Vacuum, Electrical; Liquid, Electrical; Liquid)
HIGH-VOLTAGE BREAKDOWN IN VACUUM AND IN OIL
L.H. Bettenhausen
Battelle Memorial Institute, Columbus, OH
BRI Report No. BRI-197-12-1 (10/1962).
Availability: AD-694022
NTIS

A summary is given of the state of knowledge and current research into high-voltage breakdown in vacuum and in oil. It is directed toward engineers who will use vacuum and oil as electrical-insulation media. The nature of the breakdown phenomena in vacuum is discussed. Current research into vacuum breakdown is then considered. A description of the breakdown phenomena in liquid dielectrics is the next topic, with emphasis on the behavior of insulating oils. The amount of source literature available on the topic of liquid dielectrics is staggering. Three reviews of this subject have been published within the past year alone; the reader will be referred to these for a more detailed treatment. While recent reviews of vacuum-breakdown phenomena have appeared, considerable new information has become available and is included herein for additional assessment. 169 Refs.

Primary Keywords: Vacuum Breakdown; Qualitative Overview; Electrode Effects; Modeling; Surface Flashover; Oil Breakdown; Modeling

5697 INDUCTANCE EFFECTS IN ENERGY DIVERTER DISCHARGE CIRCUITS
G.W. Taylor and S. Schneider
ECOM, Fort Monmouth, NJ 07703
No. ECOM-2529, 2p (11/1964).
Availability: AD-611 276
NTIS

The effectiveness of energy-diverter protection can be reduced by the presence of inductance between the energy diverter and the 'protected system'. Two primary effects caused by inductance have been noted. The first effect occurs when the fault-sensing circuit triggers the energy-diverter during a high-impedance fault. In this case, large voltage oscillations about the zero-voltage reference level appears at the 'protected system'. If the inductance is large, the oscillation will be maintained for a long period and will prevent quick removal of voltage. The second effect occurs when the fault-sensing circuit triggers the energy diverter during a low-impedance arc. In this case the large inductance retards arc quenching. As the arc attempts to quench, the voltage oscillation reappears because of the energy stored in the inductor, and arc quenching is prevented. Observations on a system and an analysis of the circuit are discussed. (Author)

Primary Keywords: ELECTRONIC SWITCHES-ELECTRIC DISCHARGES; SWITCHING CIRCUITS-ELECTRONIC SWITCHES; INDUCTANCE; TRIGGER CIRCUITS; VOLTAGE; OSCILLATION; ELECTRONICS; ELECTRICAL IMPEDANCE; ENERGY; DELAY CIRCUITS

5698
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)
INFLUENCE OF ELECTRODE MATERIAL ON HIGH-VOLTAGE VACUUM BREAKDOWN
M.M. Zinn, G.W. Taylor and M.H. Chrepta
ECOM, Fort Monmouth, NJ 07703
Research and Development Technical rept. No. ECOM-2901, 16p (01/1968).
Availability: AD-664 145
NTIS

The question of which electrode in a two-electrode system, the anode or the cathode, contributes most to the primary voltage breakdown mechanism, and the reasons for this contribution have been the subject of wide debate among workers in the field. Theories of breakdown that involve the anode or the cathode or both to varying extent have been proposed by Cranberg, Alpert et al., Slivkov, Utsumi and Dalman, and others. Recent data collected by Zinn, Mulcahy, and Chrepta and by Zinn and Chrepta, submitted to analysis, indicate a role of the anode material in the breakdown process sufficiently clear to be applied in high-voltage vacuum tube construction. Both the analysis and data collected by Taylor and Chrepta indicate that heating of the anode owing to the flow of field emission is a primary cause of breakdown at spacings of interest in vacuum tube technology. (Author)

Primary Keywords: Electric Discharges; Vacuum; Electrodes; Materials; Voltage; Theory; Regression Analysis; Field Emission

Secondary Keywords: Breakdown(Electrical)

5699
(ELECTROMAGNETIC LAUNCHERS)
(Rifles)
INVESTIGATION OF AN ARC GUN
T. Fujii, E.P. Palmer and R.W. Graw
University of Utah, Salt Lake City, UT
Mo. und 6, 2p (08/1960).
Availability: AD-604 499
NTIS

To satisfy needs for a superior hypervelocity gun, a study was made of the possibility of converting the electrical energy in a capacitor bank to kinetic energy of a projectile through the use of an electric arc discharge in a gun chamber. An arc gun was developed consisting of a chamber with a pair of electrodes and an accelerating barrel. To operate the gun, the chamber is packed with lithium hydride and the barrel is fitted with a nylon pellet. The capacitor bank is discharged into the chamber, causing conversion of the lithium hydride into a low-molecular gas. The expansion of the light gas accelerates the pellet. With a 3.6 microfarad capacitor bank charged to 10 kilovolts, a 3.7 milligram nylon projectile was accelerated to 5.0 kilometers per second. The efficiency of the energy conversion from the capacitor to the arc was 58.2 per cent, and the efficiency of the energy conversion from the arc to the projectile was 1.82 per cent. The total efficiency of the energy conversion from the capacitor to the projectile was 1.1 per cent. (Author)

Primary Keywords: ELECTRIC GUNS; LIGHT GAS GUNS; HYPERVELOCITY GUNS; LIGHT GAS GUNS; ELECTRIC ARCS; FIRING MECHANISMS (WEAPONS); GUN COMPONENTS; LITHIUM COMPOUNDS; HYDRIDES; NYLON; PELLETS; PROJECTILES; PROPULSIONS; TRIGGER CIRCUITS; ENERGY CONVERSION

Secondary Keywords: ARC GUNS

5701
(BREAKDOWN STUDIES)
(Gas, Electrical)
METHODS FOR DETERMINATION OF TRANSPORT COEFFICIENTS FROM HIGH POWER ARCS
H. Heckeck
Technische Hochschule Munich (West Germany) Elektrophysikalisches Institut
Final scientific rept. 1 Oct 62-31 Jan 67 (10/1967).
Availability: AD-661 995
NTIS

Analytical methods and instruments were developed to aid in the study of transport coefficients in nitrogen, hydrogen, and argon arcs at temperatures above 15,000K. The transport properties considered were electrical conductivity, heat flux potential, thermal conductivity, and specific radiation.

Primary Keywords: Electric Arcs-Transport Properties; Plasma Medium-Transport Properties; Gas Discharges-Transport Properties; Gas Ionization; Laboratory Equipment; Argon; Line Spectrum; Intensity; Hydrogen; Nitrogen; Electrical Conductance; Thermal Conductivity

5703
(BREAKDOWN STUDIES)
(Gas, Optical)
GAS BREAKDOWN BY SINGLE 20PS, 1.06UM AND 0.53UM LASER PULSES
C.L.M. Ireland and C.G. Morgan
University College of Swansea, Singleton Park, Swansea, Wales
Journal Of Physics D: Applied Physics, Vol 7, No. 8, pp L87-L90
(05/1974).

The pressure dependence of the intensity for optical frequency breakdown of nitrogen and argon has been studied using single 20 ps, Nd³⁺ laser pulses at the fundamental and second harmonic frequencies. The gases were studied over a pressure range of 10⁻²-10⁻⁵ Torr at 0.04-10⁵ Torr at 0.53 μm. The results lend support to the view that breakdown at both frequencies proceeds via cascade collisional ionization rather than by multiphoton ionization. 15 Refs.

Primary Keywords: Pressure Dependence; Nitrogen And Argon; Cascade Collisional Breakdown; Multiphoton Ionization

COPYRIGHT: 1974 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5706
(INSULATION, MATERIAL)
(Solid)
SILICONE RUBBER GRADED CONSTRUCTION FOR HIGH VOLTAGE INSULATION
S.J. Nizinski
Dow Corning Corp, Midland, MI
(01/1961).
Availability: AD-656 174
NTIS

The results obtained show that the electric strength of silicone rubber insulation cable can be increased by using a graded construction, where one layer has a high dielectric constant and the other a low dielectric constant. Silicone rubber is easily adapted to this method because the dielectric constant can be varied from 3 to 7.5 by varying the amount of titanium dioxide added to the silicone rubber base. By making use of silicone rubber's versatility the breakdown voltage was increased by 50%. The amount of increase in breakdown voltage obtained depends upon the variables mentioned in the discussion of the calculated breakdown voltages. The capacitance also increases along with the breakdown voltage. This variation may or may not be important depending upon the application. Two possible applications of graded constructions are ignition cable and gas-tube-sign cables. (Author)

Primary Keywords: Electric Insulation-Silicone Plastics; Voltage; Dielectric Properties; Electric Cables; Manufacturing Methods

5709
(BREAKDOWN STUDIES)
(Exploding Wires)
INSTABILITIES OF ELECTRICALLY EXPLODED WIRES
A.E. Vlastos
The Royal Institute of Technology, Sweden
Journal Of Applied Physics, Vol. 44, No. 4, pp 1616-1621 (04/1973).

The experimental results summarized in this paper, which have been obtained with thin tungsten, copper, and constantan wires, give further evidence that electromagnetic macroinstabilities may develop near the melting point of thin wires which are heated by the sudden release of electrical energy and lead to their disintegration. At low-energy-input rates, screw-type instabilities develop in all the wire materials. On the other hand, at higher-energy-input rates, the copper and constantan wires show striations after the explosion, while tungsten wires are not striated but are split into tiny fibers which emerge along the whole wire. At the beginning the restrike channel of copper and constantan wires has an helicoidal form. Annealed wires show the same results. Helical channels were not observed in tungsten wires. By twisting the copper and constantan wires in the opposite direction to the channel helix, it was possible to change the direction of the helix. Thus, the helical shape of the channel may be an effect produced by the twisting of the wire in mounting it between the electrodes. The possibility that the helicoidal shape of the channel is due to some other effect is also discussed. 17 Refs.

Primary Keywords: Exploding Wire; Tungsten Wire; Copper Wire; Constantan Wire; Macroinstability; Screw-type Instability

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5710
(INSULATION, MATERIAL)
(Solid)
THE INTERRELATIONSHIP BETWEEN DENSITY AND DIELECTRIC STRENGTH OF HIGH PRESSURE POLYETHYLENE FOR HIGH VOLTAGE APPLICATIONS IN INSULATED WIRES
A.S. Silver
Royal Electric Corp, Pawtucket, RI
(12/1957).
Availability: AD-656 418
NTIS

Data is presented which shows that branched P. E. manufactured by the high pressure system must be insulated properly in order to maintain a high density and crystallinity to give maximum dielectric strength in cable. (Author)

Primary Keywords: Polyethylene Plastics-Electric Insulation; Electric Wire; Density; Dielectric Properties; Crystallization; Data; Electric Cables

5711
(DIAGNOSTICS AND INSTRUMENTATION)

R.E. Ford and C.W. Stoops
Naval Research Lab., Orlando, FL
(10/1967)

Availability: AD-661 230
NTIS

A method and the electronic equipment for applying it was developed to enable the impedance of a transducer or other device, linear or nonlinear, to be calculated from measurements made while the device is operating at high power, pulsed or cw. The method involves the use of a null-balance technique by which the current and voltage of a cw reference signal are compared with samples of the 'unknown' signal and nulled against the unknown on an oscilloscope. The relative phase also is measured. Toroidal transformers provide the means of extracting samples from the high driving voltage and current. The electronic components are of solid-state circuitry throughout. (Author)

Primary Keywords: Electrical Impedance Measurement; Transducers; Test Methods; Power; Underwater Sound Equipment; Calibration; Phase Measurement; Electric Currents; Voltage; Test Equipment(Electronics)

5714
(SWITCHES, CLOSING)

(Thyristors) THE SCR AS A HIGH POWER MODULATOR SWITCH

A.S. Cardello
RADC, Griffiss AFB, NY 13440
RADC Report No. RADC TR 67-625 (12/1967).

Availability: AD 664331
NTIS

This report is a survey of the current state-of-the-art in the use of silicon controlled rectifiers in high power modulator switch series. A brief description of the device and device characteristics is included. The report describes several contractual efforts which proved the feasibility of applying the devices to high power equipments and in detail describes the device development of circuitry, triggering techniques and device improvements. The applications discussed in the report show that the silicon controlled rectifier has been used in a 5 megawatt modulator and is capable of operation at power levels of 25 megawatts and beyond. Continued efforts in this area will prove the high power capability of the device in practical applications. 8 Refs.

Primary Keywords: Silicon Controlled Rectifier; Modulator; Characterization; Performance Test; Triggering Considerations

5715
(PARTICLE BEAM, ION)
(Generation)

ION ACCELERATION IN A MAGNETICALLY INSULATED DIODE
Y.I. Bakshayev, P.I. Blinov, G.I. Dolgachev and V.A. Skoryupin
Soviet Journal of Plasma Physics, Vol. 5, No. 5, pp 583-584 (09/1979).
Trans. From: Fizika Plazmy, Vol. 5, pp 1041-1043

Experiments have been carried out to determine the mechanism for the formation of the anode plasma and to study the ion acceleration in a magnetically insulated coaxial diode. The anode plasma forms as a result of electron bombardment of the polyethylene anode. In a magnetic field $H = 13.3$ G, sub crv, the ion current density reaches 60 A/cm^2 while the insulation lasts 1 usec. 4 Refs.

Primary Keywords: Magnetic Insulation; Anode Plasma; Electron Bombardment; Electric Discharge

COPYRIGHT: 1980 THE AMERICAN JOURNAL OF PHYSICS, REPRINTED WITH PERMISSION

5733
HIGH-VOLTAGE PULSE MONITOR SYSTEM FOR NEUTRINO ELECTRON ELASTIC SCATTERING

C. Dalton
Los Alamos National Labs, Los Alamos, NM 87545
(08/1980).

Availability: LA-8505-MS
NTIS

The Neutrino Electron Elastic Scattering Experiment will use 40 high-voltage pulsers and 40 flash-chamber detector modules. This report describes the proposed microprocessor-controlled monitor system to acquire the set-up and efficiency data from the high-voltage pulsers and flash chambers. (ERA citation 05:03705)

Primary Keywords: Data Acquisition Systems; High-voltage Pulse Generators; Target Chambers; Lamp of Line; Microprocessors; Neutrino-electron Interactions; On-line Control Systems

Secondary Keywords: ERDA/430303; NTISDE

5782
(BREAKDOWN STUDIES)

(Gas, Electrical) PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM (FINAL REPORT)

C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
(11/1979)

Availability: EPRI-EL-1264
NTIS

The adverse influence of conducting particle contaminants in gas-insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and dc voltages to 1500 KV. Particle dynamics was shown to be important and related to breakdown initiation in the gas. Both SF₆ sub 6 and N₂ sub 2 gases at pressures from 1 to 14.6 atm absolute were used. The particles were intentionally introduced and ranged from 1.6 to 6.4 mm spheres and wires. Effects in the gas gap as well as along surfaces of solid insulators were studied. Visual observations, photographs, and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor. By coordination of this work with a separate study at the Westinghouse R and D laboratory, a comparison between dc and ac performance was made. Generally the dc breakdown values exhibited wider scatter, though their lower limit was similar to that found under ac. Overall fundamental forces and processes which involve particle contamination effects were identified and found to be the same for dc and ac voltage stresses. (ERA citation 05:015703)

Primary Keywords: Gas-insulated Cables; UHV DC Systems; Aluminum, Lead, Copper Cables; Comparative Evaluations; Dielectric Materials; Electrical Insulation; Experimental Data; Graphs; Nitrogen; Particles; Power Transmission Lines; Pressure Dependence

Secondary Keywords: ERDA/200302; NTISDE

5798
(PULSE GENERATORS)

(Marx) A SOLID STATE NANOSECOND PULSER USING MARX BANK TECHNIQUES

E.A. Jung and R.N. Lewis

Argonne National Lab, Argonne, IL

Nuclear Instruments And Methods, Vol. 44, No. 2, pp 224-228 (10/1966).

This pulser generates a 5 KV pulse into 50 ohm, 17 nsec after receiving a .35 V input signal. The voltage is derived from capacitors which are charged in parallel and discharged in series.

Avalanche transistors are used as the switching elements from the 0 to 1 KV level, while Elkontron spark gaps are used from the 1 to 5 KV level.

Pulse repetition rates in excess of 100 pps at readily obtainable and output pulse jitter is less than 1 nsec. 4 Refs.

Primary Keywords: Solid State Pulser; Marx Generator; Avalanche

Transistor; 5 KV Output Voltage; Repetrate

COPYRIGHT: 1966 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

5801

(ENERGY CONVERSION, ELECTRICAL; PULSE GENERATORS)

(Charging Circuits; Marx)

CHARGING TIME OF A HIGH-VOLTAGE IMPULSE GENERATOR

G.W. Swift

University of Manitoba, Winnipeg, Manitoba, Canada

Electronics Letters, Vol. 5, No. 21, pp 534 (10/1969).

The charging characteristics of Marx generators are considered. A time constant is defined by taking the product of the total parallel capacitance and total series resistance. This time constant will give the time required to charge a bank of several sections to 93% of its final value. 0 Refs.

Primary Keywords: Marx Generator Charging; Waveform Prediction; Time Constant Definition; Theoretical Justification

COPYRIGHT: 1969 INSTITUTION OF ELECTRICAL ENGINEERS

5802

(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

ENERGY STORAGE AND TRANSFER WITH HOMOPOLAR MACHINE FOR A LINEAR

THETA-PINCH HYBRID REACTOR

H.F. Vogel (1), M. Brennan (2), W.G. Dase (2), K.M. Tolok (2) and W.F. Nelson (2)

(1) Los Alamos National Lab, Los Alamos, NM 87545

(2) University of Texas at Austin, Austin, TX 78712

Los Alamos Report No. LA-6174 (12/1975).

Availability: LA-6174

NTIS

This report describes the energy storage and transfer system for the compression coil system of a linear theta-pinch hybrid reactor (LTPHR). High efficiency and low cost are the principal requirements for the energy storage and transfer of 25 MJ or 25 GJ for a 1-km LTPHR. The circuit efficiency must be approximately 90%, and the cost for the circuit 5 cents/J. Scaling laws and simple relationships between circuit efficiency and cost per unit energy are given. Concerns the output multiplication rate of 2.25 pulses per second, 70E6 shots/yr, 1.7E9 shots over the 25-yr plant life. Current interruption to initiate energy transfer is not feasible at this rate. We consider, therefore, a simple ringing circuit with contactors to make and break at the periodically occurring zero-current instances. Even this simple operation will require considerable development effort for an inexpensive and reliable contactor that may be replaced during annual plant maintenance. We consider capacitors and homopolar machines as energy storage elements with both functioning basically as capacitors. The advantage of the homopolar machine in this application is its relatively low cost, whereas that of capacitors is better efficiency. 12 Refs.

Primary Keywords: Homopolar Generator; Energy Transfer; High Efficiency; Rep-rated; High Reliability

5824

INVESTIGATION OF THE EROSION PHENOMENON IN HIGH CURRENT, HIGH PRESSURE GAS DISCHARGES

J.E. Gruber and R. Suess
Institut für Plasmaphysik, Garching, FRG
(12/1969).

Availability: IPP-4/72

NTIS

For abstract, see NSA 25 04, number 07379.

Primary Keywords: Plasma Medium; Gas Discharges

5827

(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)

(Marx, Park Generators); MARX--AND MARX-LIKE--HIGH-VOLTAGE GENERATORS

R.A. Fitch

Maxwell Labs Inc, San Diego, CA 92123

IEEE Transactions On Nuclear Science, Vol. NS-18, No. 4, pp 190-198 (04/1971).

Major developments have taken place in the art of Marx generating in recent years. The rationales, modi operandi and relative merits of these developments are discussed in an attempt at exegesis and classification. 7 Refs.

Primary Keywords: Marx Generator; Principles Of Operation; History; Design Considerations; Folded Marx; Back-coupled Marx

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

5839

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas, Optical; Gas Gaps, Optical)

ELECTRICAL DISCHARGE THROUGH LASER-INDUCED SPARK

V.I. Vladimirov, G.M. Malyshev, G.T. Razdoborin and V.V. Semenov

A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the

Ukrainian SSR, Leningrad

Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1277-1279 (03/1968).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1742-1745 (September 1967)

An electrical discharge occurs in a region produced by a laser-induced spark in air at potentials two-to-three orders of magnitude lower than the breakdown potential of air. The initiation of the breakdown is associated with the arrival of a region of reduced density at the electrode. For electrode potentials from 30 V to 3 KV the peak current ranges from 50 A to 11 KA and the resistance varies from 0.5-0.07 ohm. The duration of current flow is about 40 microseconds. 6 Refs.

Primary Keywords: Reduced Density Region; Electrode Effects; Low Resistance; Blast Wave

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

- 5840**
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas Gaps, Optical)
INVESTIGATION OF AN ELECTRIC DISCHARGE ACROSS A LASER SPARK
V.I. Vladimirov, G.M. Malyshov, G.T. Razdoborin and V.V. Semenov
A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the
Ukrainian SSR, Leningrad
Soviet Physics-Techical Physics, Vol. 14, No. 5, pp 677-680 (11/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 59, 906-910 (May 1969).

Behind the front of the shock wave a laser spark produces a hot region which creates conditions for the initiation of an electric discharge. The shock wave is separated from the boundaries of the hot region at a velocity of 365 cm/sec 100 nsec after the start of the laser spark. The onset of the discharge depends on the position of the electrodes relative to the center of the hot region. The developed discharge is self-sustaining.

Primary Keywords: Tungsten Electrode; Variable Focal Plane Position; Low Voltage; Gap Resistance Measurement

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5841
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Optical; Vacuum Gaps, Optical)
LASER-INITIATED VACUUM DISCHARGE
V.P. Kovalenko, A.A. Makarevich, V.A. Rodichkin and A.M. Timanin
Soviet Physics Technical Physics, Vol. 19, No. 11, pp 1429-1431
(05/1975).
Trans. From: Zh. Tekh. Fiz. 44, 2317-2321 (November 1974).

The current-pulse and time characteristics of a vacuum discharge (initial pressure $p=2\times 10^{-6}$ Torr) are studied in a two-electrode gap. The discharge is driven by the light pulse from a 15 MW ruby laser, which is focused on one of the electrodes. As the laser-produced plasma expands across the gap, a current flows due to the emission of charged particles from the plasma and changes caused in the strength and configuration of the electric field in the gap by the laser plasma. The maximum current across the gap and the time required for the current to reach its maximum value are functions of the gap voltage (U_{gap} of $5-50$ KV) and the capacitance (C_{gap} of $1100-4400$ pF). 3 Refs.

Primary Keywords: Laser Initiated Breakdown; Variable Polarity; X-ray Burst; Intensity Dependence; Very Short Delay Time

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5844
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PHYSICS OF A SPARK VACUUM DISCHARGE AND QUANTITATIVE MASS-SPECTROMETRIC ANALYSIS. QUALITATIVE MODEL OF A WEAK CURRENT VACUUM DISCHARGE
G.I. Remendin and V.I. Derzhiev
V. I. Vernadskii Institute Of Geochemistry And Analytical Chemistry,
Academy Of Sciences Of The USSR, Moscow, USSR. Moscow, USSR
Journal Of Analytical Chemistry Of The USSR, Vol. 32, No. 8 pp
1197-1203 (08/1977).
Trans. From: Journal Angliticheskoi Khimii 32, 1508-1515 (August 1977).

The authors present evidence for a model of the physics of vacuum breakdown. Three distinct stages are proposed and defined: breakdown initiation, spark, and arc. Each stage is described in detail with theories presented for the mechanism of each stage. The passage of electrode material into the vacuum gap is discussed, as is the effect of electrode vaporization on the speed of breakdown. Particle density in the plasma channel formed is investigated. Recovery processes are also briefly discussed. 37 Refs.

Primary Keywords: Vacuum Breakdown; Three Stages; Breakdown Initiation; Spark; Arc; Plasma Formation; Recovery After Current

Secondary Keywords: Ion-source Mass Spectrometry

COPYRIGHT: 1977 PLENUM PUBLISHING CORP., REPRINTED WITH PERMISSION

5846
(PARTICLE BEAMS, ION)
(Generation)
ACCELERATION OF CHARGED PARTICLES BY INTENSE ELECTRON BEAMS
G. Yonas
Sandia Labs, Albuquerque, NM 87115
Particle Accelerators, Vol. 5, pp 81-91 (01/1973).

Ion acceleration by electron beams propagating in a plasma or neutral gas has resulted in the generation of ion beams with energies much greater than the accelerating e-beams. The ion acceleration occurs as the e-beam pinches in all cases. The author experimentally and theoretically investigates collective acceleration in a plasma filled diode. Results are presented to indicate that accelerating fields of over 1 MV/cm can be obtained in a diode. 33 Refs.

Primary Keywords: Collective Acceleration; Plasma Filled Diode; 1 MV/cm Accelerating Field; Experiment; Theory

COPYRIGHT: 1973 GORDON AND BREACH, SCIENCE PUBLISHERS LTD.

5851
(BREAKDOWN STUDIES)
(Lightning)
DETECTION OF LIGHTNING SUPERBOLTS
B.N. Turman
Patrick AFB, Florida 32925
Journal Of Geophysical Research, Vol. 81, No. 18, pp 2566-2568
(06/1977).

Lightning superbolts are the subject of this paper. The authors briefly describe the criteria that qualify a superbolt and proceed to describe the statistics of lightning superbolts. The primary criteria used are optical radiance and duration. Satellite based sensors are utilized as detection devices. 12 Refs.

Primary Keywords: Lightning Detection; Superbolt Detection; Superbolt Statistics; Optical Radiance

COPYRIGHT: 1977 AMERICAN GEOPHYSICAL UNION

5854
(BREAKDOWN STUDIES)
(Surface Flashover)
ELECTRICAL BREAKDOWN OVER INSULATORS IN HIGH VACUUM
P.H. Gleicher
Westinghouse Research and Development Center, Pittsburgh PA
Journal Of Applied Physics, Volume 22, No. 5, pp 535-541 (05/1951).

In the investigated range of $5E-3$ to $1E-7$ mm Hg, the breakdown voltage over insulators in high vacuum is independent of pressure. Currents of $1E-11$ to $1E-8$ ampere were observed in the region below breakdown voltage by detecting x-ray quanta with a Geiger-Muller counter. Pinhole camera x-ray pictures revealed that practically all radiations originate from an area on the anode a distance from the insulator, with a weaker radiation coming from a ring immediately adjacent to the insulator. Current-voltage relationships as usually observed in these experiments indicate roughness factor and an emitting area on the cathode similar to previous findings in vacuum gaps. Oscilloscopic observations revealed that sometimes at breakdown over insulators with gaps of $1-2$ mm the breakdown voltage is $2-5$ times higher than the breakdown voltage of the same sample broken down in air. In other cases, it falls to less than 10% of the air value. The low voltage arc-like discharge extinguishes at a current of about one ampere for copper electrodes in contact with Pyrex glass. As in a vacuum gap, the breakdown voltage over an insulator is increased by successive breakdowns. Part of this 'conditioning' is permanent. The non-permanent part is dependent on the state of the test sample prior to conditioning. 10 Refs.

Primary Keywords: Surface Flashover; Pyrex Insulator; Copper Electrodes; High Vacuum; X-ray Diagnostic; Voltage Measurement; Cutoff Current; Conditioning Effects

COPYRIGHT: 1951 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5855
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON BEAM FOCUSING USING CURRENT-CARRYING PLASMAS IN HIGH-NU/GAMMA DIODES
G. Yonas, K.R. Prestwich, J.W. Poukey and J.R. Freeman
Sandia Labs, Albuquerque, NM 87115
Physical Review Letters, Vol. 30, No. 5, pp 164-167 (01/1973).

A technique has been demonstrated for concentrating electron beams to $5E-3$ A/sq.cm. plasmas on the axis of diodes. A two-dimensional particle code has been used to illustrate the importance of both the $E \times B$ motion in vacuum and the self-pinch of the beam within the plasma. 3 Refs.

Primary Keywords: Electron Beam Focusing; Diode Axis; High Nu/gamma Diodes; Self-pinned Diode; Current-carrying Plasmas; Theory; 2-d Particle Code

COPYRIGHT: 1973 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

5860
(SWITCHES, CLOSING)
(Liquid Gaps, Self)
HIGH POWER DENSITY WATER DIELECTRIC SWITCHING
D.L. Johnson, J.P. Vandevender and T.H. Martin
Sandia Labs, Albuquerque, NM 87115
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 204-209

(09/1980).

Pulse forming networks for high current particle beam fusion accelerators must produce fast rise time, low jitter, low prepulse, and high voltage power pulses. Conventional water dielectric switching can provide the required rise time and jitter, but has limitations on prepulse and output voltage. A high power density, low prepulse, pulse forming line (PFL) configuration with self-breakdown water dielectric switches is presented. The design parameters and the results of switching experiments are described. 7 Refs.

Primary Keywords: Self-break Water Switch; Prepulse Suppression; Ground Plane; Pulse Forming Line

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

5865
(BREAKDOWN STUDIES)
(Lightning)
LIGHTNING DETECTION FROM SPACE
B.N. Turman
U.S. Air Force Academy, CO 80840
American Scientist, Vol. 67, No. 3, pp 321-329 (06/1979).

The author presents data on satellite lightning detection in this paper. Reasons are presented for using optical sensors for detecting lightning from space. The energy distribution of lightning is discussed and the presence of superbolts is hypothesized and confirmed. The waveshapes of lightning are studied, as is the probability that the bolt will have a given total energy and charge transfer. The possibility of implementing a satellite-based severe storm early warning system is discussed. 23 Refs.

Primary Keywords: Lightning; Normal Bolt; Superbolt; Positive Giant; Ground-Based Optical Lightning Detection; Storm Monitoring

COPYRIGHT: 1979 SIGMA XI, THE SCIENTIFIC RESEARCH SOCIETY INC.

5867
(INSULATION, MAGNETIC)
()
MAGNETIC INHIBITION OF SURFACE FLASHOVER OF INSULATORS IN VACUUM
K.D. Bergeron and D.H. McDaniel
Sandia Labs, Albuquerque, NM 87115
Applied Physics Letters, Vol. 19, No. 9, pp 534-536 (11/1976).

The possibility of preventing high-voltage surface flashover of insulators in vacuum by means of a strong magnetic field perpendicular to the electric field and parallel to the insulator surface is investigated theoretically. A simple model predicts that with the right choice of insulating materials, one can design diodes and transmission lines so that the magnetic field from the line current inhibits the secondary-electron-emission avalanche which is believed to play an important role in the flashover process. 13 Refs.

Primary Keywords: Surface Flashover; Modeling; Diode; Transmission Line; Theory; Secondary-electron-emission Avalanche

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5870
(DIAGNOSTICS AND INSTRUMENTATION)
(Particle Beams)

MEASUREMENTS OF HIGH-CURRENT RELATIVISTIC ELECTRON DIODE PLASMA PROPERTIES WITH HOLOGRAPHIC INTERFEROMETRY

J.G. Kelly and L.P. Mizell
Sandia Labs, Albuquerque, NM 87115

Journal of Applied Physics, Vol. 46, No. 3, pp 1084-1090 (03/1975).
Double-exposure interference holography has been used to measure the temporal and spatial dependence of plasma densities and velocities in relativistic electron beam diodes. In this paper some of the physics revealed by a detailed analysis of holograms from one such diode is presented. Abel inversion of holograms taken on the Reba accelerator (100 kA, 1.5 MV) incorporating a 0.6-cm-diam glass rod cathode show the axial and radial structure of the diode plasmas. Fringe-shift analysis has yielded densities of $5E17 - 5E19$ electrons/cm³, and magnetohydrodynamic pressure balance implies a plasma temperature of about 0.3 keV. In addition, exposure variation of the fringe patterns between pictures taken at different times during the pulse have yielded plasma velocities vs spatial position that vary from 166 to 185 cm/sec. 12 Refs.

Primary Keywords: E-beam Generation; Field Emission Diode; Diode Plasma; Holographic Interferometer; REBA Accelerator

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5872
(PARTICLE BEAMS, ION; PARTICLE BEAMS, NEUTRAL)
(Generation; Generation)

NEUTRON PRODUCTION AND COLLECTIVE ION ACCELERATION IN A HIGH-CURRENT DIODE

L.P. Bradley and G.W. Kuska
Sandia Labs, Albuquerque, NM 87115

Physical Review Letters, Vol. 29, No. 21, pp 1441-1445 (11/1972).
New measurements demonstrate that neutrons produced in a high-current pulsed diode with deuterium-bearing electrodes are of beam-target origin. During a brief portion of a 70-nsec, 2-MV, 50-kA pulse, positive ions from the anode and cathode plasmas were observed to be accelerated toward the anode rather than the cathode as dictated by the externally applied field. Energetic deuterons were observed, behind a small aperture in the anode, which were the source of neutrons produced with Li or C anodes. 12 Refs.

Primary Keywords: Collective Acceleration; Neutron Production; High Beam Energy; High Beam Current; Positive Ion; Anode Plasma; Cathode Plasma; Lithium Anode; Carbon Anode

COPYRIGHT: 1972 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

5881
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gap; Optical)

PREIONIZATION CONTROL OF STREAMER PROPAGATION

L.P. Bradley
Sandia Labs, Albuquerque, NM 87115

Journal of Applied Physics, Vol. 43, No. 3, pp 886-890 (03/1972).
Streamer velocity is experimentally shown to vary with preionization in $N_{\text{sub}}/2$ and $SF_{\text{sub}}/6$. The velocity has been controlled over orders of magnitude by introducing pulsed preionization ahead of an already propagated streamer. The preionization is produced by pulsed UV irradiation. The pulsed electric field is uniform in the gap. Avalanche-streamer conversion times were observed which agree well with prediction. 13 Refs.

Primary Keywords: Streamer Velocity Control; Quasistatic Preionization; Pulsed Preionization; Wide Range Of Control

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5882 PRELIMINARY DESIGN OF A 100 Hz, 350 KV SHORT PULSE GENERATOR

G.J. Rohwein and M.T. Butttram
Sandia Labs, Albuquerque, NM 87115

Availability: SAND-77-0174 NTIS

This report describes a 350 KV pulser designed to generate 100 ns square pulses with 300 joules total energy at a pulse repetition frequency of 100 per second. This design incorporates a transformer charged helical coaxial pulse forming line. The considerations leading to this design are presented together with results from prototype experiments. The pulser which is presently in the construction and testing phase is described in detail. The pulser will be used for electron beam acceleration. (ERA citation 02:055490) Primary Keywords: Electron Sources; Pulse Generators; Design; Electron Beams; Performance Testing; Power Supplies; Transformers

Secondary Keywords: ERDA/700203; ERDA/700208; NTISERDA

5893
(PARTICLE BEAMS, ELECTRON)
(Generation)

Z/SUB E < 3 OHM PINCHED ELECTRON DIODES

J.W. Poukey
Sandia Labs, Albuquerque, NM 87115

No. CONF-751108-2, 9p (06/1977).

Availability: SAND-75-5747 NTIS

High current pinched electron flow in diodes is shown to be self-limiting, in the sense that for given diode voltage the electron current approaches a limiting value as R_d (cathode radius/gap) increases indefinitely. The consequence is that in order to achieve electron impedances $Z_{\text{sub}}/2$ or less than 1 ohms, one may have to inject high-atomic-weight plasma into the diode.

Primary Keywords: Electron Sources; Design; Electron Beams; Pinch Effect; Plasma

Secondary Keywords: NTISERDA

5894
(BREAKDOWN STUDIES)
(Gas, Electrical)

CENTRING A HIGH-CURRENT ARC IN A COAXIAL ARC CHAMBER

E.K. Inall
Australian National University, Canberra, Australia

J. Phys. D, Applied Physics, Ser. 2, Vol. 1, pp 1584-1588 (07/1968).
When an electric arc carrying 100 kA or more occurs a few mm off the axis of a coaxial chamber, it experiences a force of several kg/cm² of arc length, driving it further off the axis. This can be overcome and the arc maintained on the axis by dividing one electrode and the outer conductor into sectors. With such an arrangement arcs of more than 100 kA have burnt on the axis for the duration of runs lasting 0.5 s. 1 Refs.

Primary Keywords: Coaxial Arc; High-current; Segmented Electrode; Long Duration Arc; Force Analysis

COPYRIGHT: 1968 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5895
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

CORRELATED ELECTRICAL AND OPTICAL MEASUREMENTS OF EXPLDING WIRES
F.D. Bennett, H.S. Burden and D.D. Shear
Army Ammunition Research and Development Command, Aberdeen Proving Ground, MD 21005

The Physics of Fluids, Vol. 5, No. 1, pp 102-113 (01/1962).
Description is given of a high-resolution streak camera and of an experimental method whereby streak-camera records and electrical measurements of exploding wires may be accurately correlated in time. Composite data together with derived values of resistance, power, and energy are given for 4 and 5 mil Cu wires at several voltages. These data are compared with the experimental and theoretical results of other workers. The transfer of energy from electrical to fluid-mechanical form is discussed as are problems having to do with formation of the shock waves. 30 Refs.

Primary Keywords: Current Measurement; Voltage Measurement; Streak Photograph; Back Lighting; Peripheral Arc

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5896
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Explosive Fuses; Current)

CURRENT MEASUREMENT AND TRANSIENT SKIN EFFECTS IN EXPLDING WIRE CIRCUITS

F.D. Bennett and J.W. Marvin
Army Ammunition Research and Development Command, Aberdeen Proving Ground, MD 21005

Proc. Inst. of Scientific Instruments, Vol. 33, No. 11, pp 1218-1226 (11/1962).

The transient response of the coaxial, current-measuring shunt commonly used in high-current, high-frequency applications (up to 1 MHz) is analyzed by Laplace transform methods. The exact solution is obtained as is an approximate solution which allows estimates to be made of the errors expected. The current shunt measuring a damped oscillation will always report an initial current slope of zero, and the maximum current slope is sensed shortly after switch-on. It is several percent low in typical cases. At the true current maximum, the shunt reading is a few tenths percent low and lags the impressed current by a small fraction of a cycle. A second problem concerning the transient resistance of an idealized plate condenser is analyzed using the asymptotic solution for current. A numerical calculation indicates no alteration of initial conditions on the damped oscillation to arise from this source so long as the characteristic damping time of the transient skin effect is small compared with the ringing time. 14 Refs.

Primary Keywords: Current Measurement; Coaxial Current Shunt; Laplace Analysis; Error Estimate

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5897
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

HIGH-ENERGY DENSITIES BEFORE DWELL IN ELECTRICALLY EXPLDING WIRES
F.H. Webb Jr., H.H. Bingham and A.V. Tollestrup
Electro-Optical Systems, Inc., Pasadena, CA

The Physics of Fluids, Vol. 3, No. 2, pp 318-319 (04/1960).

High-energy densities above 10 eV/eon have been placed in electrically exploded wires before current dwell. Power input and electrical conduction above the critical point are inferred. Localized overheating has been discussed and the possible occurrence of this type of overheating. Further evidence also has been reported involving temperatures above 50000 K in exploding wires. Our results confirm theirs under different conditions. Our experiments took place in much shorter time intervals (1E-8 sec) where the energy losses due to radiation and any air-breakdown across the gap are negligible during the initial conduction phase. The voltage and current were measured simultaneously using a resistive shunt and voltage divider and two traveling wave oscilloscopes. A series of single-frame photographs were also taken. The overheating has been achieved in fine wires of good conducting materials in circuits where the initial current rise is extremely rapid, and the resistance is slightly larger than the circuit resistance initially. The essential feature is to establish a large current density in the wire before the resistance increases sufficiently to throttle further current flow. 4 Refs.

Primary Keywords: Exploding Wire; Initial Stages; Energy Density Before Current Pulse; Critical Point; Aluminum Wire

COPYRIGHT: 1960 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5898
(SWITCHES, OPENING; BREAKDOWN STUDIES)

(Exclusive Fuses; Exploding Wires)

INITIAL PHASE OF THE EXPLDING WIRE PHENOMENON

C.P. Nash and C.W. Olsen
University of California, Davis, CA

The Physics of Fluids, Vol. 1, No. 2, pp 209-213 (02/1964).
An approximation to the behavior of a circuit containing an exploding wire is given. The differential equation for the discharge of a condenser through a resistive load which increases linearly with time has been solved analytically. The calculations indicate that inductive effects govern the energy consumption in the first pulse for small-diameter wires, while thermodynamic effects are important for larger-diameter wires. The importance of the heat of vaporization per unit volume, the resistivity, and the temperature coefficient of resistivity is stressed. Owing to their similarities in these properties, it is predicted, and confirmed experimentally, that gold wires and aluminum wires should display nearly identical first-pulse characteristics. 14 Refs.

Primary Keywords: Exploding Wires; Analytical Calculation; Time Varying Resistivity; Inductive Effects; Thermodynamic Effects; Gold Wire; Aluminum Wire

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5899

(BREAKDOWN STUDIES: SWITCHES, OPENING)

(Exploding Wires; Explosive Fuses)

ON THE MECHANISM OF EXPLODING WIRES

C.P. Nash (1) and W.G. McMillan (2)

(1) University of California, Davis, CA

(2) University of California, Los Angeles, CA 90024

The Physics of Fluids, Vol. 4, No. 7, pp 911-917 (07/1961).

Experimental measurements are made for the energy input and shock wave arrival times for 10-cm long .46 Cu wires exploded in air at an initial voltage of 9.25 kV. Two shocks in air are observed, one for each pulse before and after the dark pause. Pulse duration measurements are also reported for wire explosions in gaseous He, N_2 sub 2%, O_2 sub 2%, Ar and CCl_4 sub 3% at 1 atm. Semiquantitative theoretical explanations are proposed for the increase in wire resistance which terminates the first current surge, and for the elapsed time (pulse duration) before the vapor density of the exploding wire material declines sufficiently for reignition of the discharge. 17 Refs.

Primary Keywords: Exploding Wire; Copper Wire; Shock Wave; Double Shock; Energy Input; Pulse Duration; Several Environments

COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5900

(SWITCHES, OPENING; BREAKDOWN STUDIES)

(Explosive Fuses; Exploding Wires)

SHOCK-PRODUCING MECHANISMS FOR EXPLODING WIRES

F.D. Bennett

Army Ammunition Research and Development Command, Aberdeen Proving Ground, MD 21005

The Physics of Fluids, Vol. 5, No. 8, pp 891-898 (08/1962).

A single-frame microprogram is presented of .46 Cu wires exploded at 20 kV into argon ambient at pressures of 1/8, 1/16, and 1/32 atm. Features discernible include a comprehensive-head shock wave, arc plasma, a weak plasma wave and the expanding metal wire. On the basis of certain plausible assumptions it is seen that the arc plasma has a temperature of about 2.5 eV; but its leading edge, a region not in thermal equilibrium, has electron temperatures approximately 1E5 eV and is the boundary of an electron-driven shock wave. 11 Refs.

Primary Keywords: Exploding Wire; Copper Wire; Comprehensive-head Shock Wave; Electron-driven Shock Wave; Plasma Wave

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5901

(DIAGNOSTICS AND INSTRUMENTATION)

(Power)

A DEVICE FOR MEASURING PULSE POWER

K.A. Yakovlev, D.K. Pankrashkin and Yu.G. Basin

Instruments And Experimental Techniques, No. 4, pp 711-713 (07/1961).

Trans. From: Priboi I Tekhnika 4, 81-91 (July-August 1961)

A design for a device to measure the instantaneous power of a pulse is presented. The device can handle currents of 50 to 2100 A at voltages up to 15 kV over a frequency range of 0.8 to 8 MHz. Pulses can have a repetition frequency to 1 kHz, and the pulse duration can be 50 microseconds to 10 ms. 9 Refs.

Primary Keywords: Pulse Power Meter; True Power Reading; 1-15 kV Voltage Range; 50-2100 A Current Range; 0.8-8 MHz Frequency Range

COPYRIGHT: 1962 PLENUM PUBLISHING CORP., REPRINTED WITH PERMISSION

5902

(ELECTROMAGNETIC COMPATIBILITY)

(Grounding And Shielding)

RADIO-FREQUENCY SHIELDING PROVIDED BY BOLTED SEAMS CONNECTING ARMORED-PLYWOOD PANELS

H.A. Lasitter

Naval Civil Engineering Lab, Port Hueneme, CA

Naval Facilities Engineering Command Report No. R-535 (06/1967).

Availability: AD 81696

NTIS

Rooms shielded against radio-frequency (RF) signals are essential to the Navy's research and development and operational use of equipment sensitive to RF interference. A series of shielding-effectiveness measurements of armored-clad plywood sections representative of those used in the construction of radio-frequency shielded rooms has been conducted. Five sections and their bolted seams were subjected to wet cycles of 70 Deg.F, 100% RH, and to dry cycles of 220 Deg.F, 10% RH. The percent moisture content, thickness variability, DC resistance, and surface currents at 12.8 kHz were observed during the wet-dry cycles. DC surface resistance of the seams increased monotonically throughout this test period. Standard deviation of the surface current measurements reached a peak at approximately 12 days. Another series of tests indicated that seams caulked with silver-loaded compounds had distribution of surface currents similar to those of solid armored sheets. 10 Refs.

Primary Keywords: Faraday Cage; Armored Plywood; Shielding Effectiveness; Variation With Temperature; Variation With Humidity; Quality Of Electrical Bond

5914

(PARTICLE BEAMS, ELECTRON)

(Target Interactions)

DEEP CRATERS PRODUCED BY SHOCK FOCUSING IN RELATIVISTIC ELECTRON-BEAM DIODES

J.C. Kelly and M.M. Widner

Sandia Labs, Albuquerque, NM 87115

Journal Of Applied Physics, Vol. 46, No. 10, pp 4519-4518 (10/1975). Narrow craters have been produced in aluminum-rod targets mounted in the anode of the Herold electron-beam accelerator (10 cm long, 44 mm dia.). These craters (approximately 0.025 cm in diameter), which are characteristically deeper than their diameter and which extend into the electrode materials significantly beyond the classical range of the primary electrons in a relativistic electron-beam diode, were generated by a converging shock wave that melted and fractured the material in the region of shock focus. It is suggested that similar craters seen by other experimenters were also produced by the same mechanism. 13 Refs.

Primary Keywords: E-beam Focusing; Converging Shock Wave; Deep Craters; Hydrodynamic Code Calculations; Shock Focusing; 103 J Total Beam Energy; 150-kV Electron Beam; Herold Electron-beam Accelerator

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5921

(PARTICLE BEAMS, ELECTRON)

(Generation)

ELECTRON BEAM GENERATION IN PLASMA-FILLED DIODES

P.A. Miller, J.W. Poukey and T.P. Wright

Sandia Labs, Albuquerque, NM 87115

Physical Review Letters, Vol. 35, No. 14, pp 940-943 (10/1975).

A study has been made of the response of low-density (approximately 1E11 cm⁻³) plasmas when subjected to the very high electric fields or relativistic-electron-beam-accelerator diodes. An anomalous resistive behavior has been seen. Instead, sheath formation at the cathode and electron-beam propagation across the sheath has been found. This has important implications to the design of diodes for future electron-beam machines. 12 Refs.

Primary Keywords: Low Density Plasma; Field Emission Diodes; Cathode Sheath Formation; Electron-beam Generation; High Electric Fields; Anode Plasma

COPYRIGHT: 1975 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

5928

(PARTICLE BEAMS, ELECTRON)

(Generation)

HIGH POWER ELECTRON BEAM ACCELERATORS FOR GAS LASER EXCITATION

J.G. Kelly, T.H. Martin and J.A. Halbleib

Sandia Labs, Albuquerque, NM 87115

(06/1976)

Availability: SAND-75-5682

NTIS

A preliminary parameter investigation has been used to determine a possible design of a high-power, relativistic electron beam, transversely excited laser. Based on considerations of present and developing pulsed power technology, broad area diode physics and projected laser requirements, an exciter is proposed consisting of a Marx generator, pulse shaping transmission lines, radially converging ring diodes and a laser chamber. The accelerator should be able to deliver approximately 20 kJ of electron energy at 1 MeV to the 10 exp 4 cm exp 2 cylindrical surface of a laser chamber 1 m long and 0.3 m in diameter in 2 ns with very small azimuthal asymmetry and uniform radial deposition. (ERA citation 02:001384)

Primary Keywords: Electrostatic Accelerators; Gas Lasers; Electron Beams; Electron Sources; Excitation; Kilo Amp Beam Currents; New Results; Planning

Secondary Keywords: ERDA/430100; ERDA/420300; NTISERDA

5933

(PARTICLE BEAMS)

(Generation)

ION SHEATH MOTION IN PLASMA-FILLED DIODES

M.M. Widner and J.W. Poukey

Sandia Labs, Albuquerque, NM 87115

The Physics Of Fluids, Vol. 19, No. 11, pp 1838-1840 (11/1976).

The time development of the ion space charge sheath in a plasma-filled planar diode is considered in reference to the behavior of relativistic diodes used for electron and/or ion beam production. 6 Refs.

Primary Keywords: E-beam Generation; Ion Beam Generation; Plasma Filled Diode; Planar Diode; Diode Closure

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5954

(BREAKDOWN STUDIES)

(Exploding Foils)

SELF-SIMILAR POWER-DRIVEN EXPANSION INTO VACUUM

K.E. Lonngren

University of Iowa, Iowa City, IA 52240

The Physics Of Fluids, Vol. 22, No. 5, pp 859-865 (05/1979).

Planar, power-driven expansion into a vacuum is found to be self-similar for a power-law driving source for the two ideal cases of a thick slab and a thin foil. For the thick slab expansion an asymptotic solution for the far-blowoff region is obtained and a numerical solution is present for the rest of the expansion wave. For the thin foil expansion, an analytical solution is obtained. In both cases, the solutions exhibit an unbounded flow field with velocities tending to infinity as a consequence of the continuum assumption, a finite temperature limit for the far-blowoff material, and density profiles that decrease as a Gaussian in the far expanded material. 15 Refs.

Primary Keywords: Exploding Foil; Expansion Into Vacuum; Thin Foil; Thick Slab; Power-law Driving Source; Self Similarity

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

5970

(SWITCHES, CLOSING)

(Liquid Gaps; Self)

UNTRIGGERED WATER SWITCHING

J.P. Vandevender and T.H. Martin

Sandia Labs, Albuquerque, NM 87115

IEEE Transactions On Nuclear Science, Vol. NS-22, No. 3, pp 979-982 (06/1975).

Recent experiments indicate that synchronous untriggered multichannel switching in water will permit the development of relatively simple, ultra-low impedance, short pulse, relativistic electron (REB) accelerators. These experiments resulted in the delivery of a 1.5 MV, 0.75 MA, 10 ns pulse into a 2 ohm line with a current risetime of 2E14 ns/step. The apparatus consisted of a 3 MV Marx generator, a 100-ohm line, a three 12.5 kV water switches separated by 2-gee-plane water-gap switches. The Marx generator charged the first line in <400 ns. The first switch then formed 5 or more channels. The second line was charged in 60 ns and broke down with 10 to 25 channels at a mean field of 1.6 MV/cm. The closure time of each spark channel along both switches was measured with a streak camera and showed low jitter. The resulting fast pulse line construction is simpler and should provide considerable cost savings from previous designs. Multiples of these low impedance lines in parallel can be employed to obtain power levels in the 1E14 W range for REB fusion studies. 6 Refs.

Primary Keywords: Water Switch; Self-breakdown Operation; Multichannel Operation; Experiment; Theory

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Liquid, Electrical)

NANOSECOND BREAKDOWN IN LIQUID DIELECTRICS

P. Feigenthal, Inc., Cambridge, MA

Journal of Applied Physics, Vol. 37, No. 10, pp 3713-3715 (09/1966). Measurements of nanosecond formative times in various liquids are summarized. The experiments utilized applied fields of up to 3.3E6 V/cm while equipment time resolution was on the order of 0.3 nsec. Detailed results are given for n-hexane including aging time histories and formative times with and without an applied bias field. The data obtained in this study are compared with earlier work. Using a simplified breakdown model the mobility of charge carriers at 2E6 V/cm is calculated to be 8.7E-2 sq.cm.V.sec. The nanosecond high-voltage insulating qualities of various liquids are discussed. 6 Refs.

Primary Keywords: Formative Time; Liquid; Liquid Breakdown; Several Liquids; High E-field; Short Pulse Insulation

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

DESIGN STUDIES FOR ULTRA-FAST, LOW-IMPEDANCE HIGH-PEAK-POWER PULSED SYSTEMS

J.L. Brewster, F.M. Cherbonnier, L.F. Garrett, K.W. Riegelmann and J.K. Trojan

Field Emission Corp., McMinnville, OR 97128

Technical rept. Apr 62-Aug 65 (11/1965).

Availability: AD-475 36975ST

NTIS

Ultrafast pulsed power systems have proved to be effective energy sources for transducers to produce intense X rays, dense electron beams, and very high temperature plasmas. The principal function of a single shot or low repetition rate pulsed power system is to accept energy at low power levels and subsequently to deliver such energy at extremely high power levels, with maximum efficiency, to a suitable transducer. This objective can best be met by use of either distributed or lumped-constant pulse forming networks where optimum performance is realized by maintaining the proper impedance match between the power source and transducer throughout the energy delivery process. Attainment of the proper impedance match can impose stringent and sometimes counter-indicating requirements upon the dielectric storage media, the switching mechanism, and the transducer chamber. The most promising approach to such power sources appears to be a pulse-chopper type stage coupled pulsed system which can deliver 25 kilojoules at 2 megavolts in a pulse width of 40 nanoseconds to a suitably matched flash X-ray tube to produce relatively high dose rates with long tube life and minimal maintenance. The performance of a Blumlein exploding wire system, with respect to the rate of energy transfer, is primarily limited by the uncancelled transducer chamber impedance to the extent required to give d/dt values close to 10 to the 14th power amp/sec for wires a few mils in diameter. Attainment

Primary Keywords: Pulse Generators; Transducers; X Rays; Electron Beams; Plasma Medium; Impedance Matching; Electrical Impedance; Dielectric Properties; X Ray Tubes; Voltage; Switching Circuits; Power Transformers; Gas Discharges; Transmission Lines

Secondary Keywords: NTISODDXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

(PULSE GENERATORS)

(Trigger)

GENERATOR PRODUCING RECTANGULAR VOLTAGE PULSES HAVING AN AMPLITUDE OF

5.5. Kengap and V.P. Smirnov

Atomic Energy Institute, Moscow, USSR

Instruments And Experimental Techniques, Vol. 16, No. 2, pp 456-457 (04/1973).

Trans. From: Prybori i Tekhnika Eksperimenta 2, 109-110 (March-April 1973)

A high-voltage pulse generator is described which is implemented using long lines (RK-5-9-12 coaxial cable). A triatron with external oil insulation is used as the commutator. The generator allows a voltage pulse having an amplitude of up to 50 kV and a length of 40 nsec with a leading-edge duration of approximately 1 nsec to be obtained across a matched 50-ohm load. Results are presented of investigations of generator operation in various modes. The generator was used in circuitry for synchronizing high-voltage devices. 2 Refs.

Primary Keywords: High-voltage Pulse Generator; 50 kV Voltage Pulse Amplitude; Blumlein Line; Triatron Switch; Rectangular Pulse Output; Nanosecond Rise Time

COPYRIGHT: 1973 PLENUM PRESS REPRINTED WITH PERMISSION

HIGH ENERGY HIGH DUTY PULSER

Authors Unknown

RCA Corp., Moorestown, NJ 08057

Final technical rept. Feb 73-Feb 74. (03/1974).

Availability: AD-A80 031/1

NTIS

The report presents the results of a one year in-depth study on achieving a high peak energy and high average power pulser. Design objectives are for a 2.5 gigawatt peak power/10 megawatt average power pulser supplying 20 microsecond pulses at 200 pulses per second. An artificial line type modulator with hydrogen thyratrons versus spark gaps versus solid state versus mercury pool switches, etc.), and on selection of a particular device of the chosen type. Hydrogen thyratrons were chosen over competing types of switches because suitable types are available "off the shelf", whereas all of the competing types require some development work to meet the requirements. A complete design, using the KU-275 hydrogen thyratron, is given. (Author)

Primary Keywords: Pulse Generators; Thyratrons; Hydrogen; High Power; Short Pulses; Switches; Modulators; Safety

Secondary Keywords: Design; Pulasers; NTISAF

(SWITCHES, CLOSING)

(Systems)

LOW-INDUCTANCE SWITCHING USING PARALLEL SPARK-GAPS

R.A. Fitch and N.R. McCormick

Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK

Proceedings of the IEE, Vol. 106, Part A Supplement No. 2, pp 117-130 (11/1959).

The parallel operation of triggered gas spark gaps is considered in this paper. The authors analyze the triggering and breakdown of tritrigators, cascade overvolted gaps, and swinging cascade gaps when switched in parallel with transit time solution. An extensive analysis is made of the effects of trigger voltage, trigger scatter, trigger cable impedance, load impedance, and type of gap used. Fault analysis is included. Experimental results are included for a bank at AWE (nicknamed Maggi). This bank utilized 200 triatron switches to give a current rise of over 1E13 A/sec. 21 Refs.

Primary Keywords: Parallel Spark Gaps; Three Spark Gap Types; Performance Test; Analysis; Tritrigator; Cascade Overvolted Gap; Field Distortion Gap

COPYRIGHT: 1959 IEE

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

SELF-CROWBARRING, LOAD-ISOLATING TRIGGERED SPARK GAP

J.W. Robinson

Pennsylvania State University, University Park, PA

The Review Of Scientific Instruments, Vol. 51, No. 11, pp 1532-1534 (11/1980).

Crowbarring is achieved when a magnetically driven arc contacts an electrode in the crowbar circuit. No auxiliary timing circuitry is required and, at the time of crowbarring, the arc divides into two parts such that the load is isolated from the source. A discharge which peaks at 200 kA in 4 microseconds is crowbarred and displays a 50-microsecond e-folding time with a ripple current of less than 5%. Main switching and crowbarring are combined in a single 3-electrode spark gap which is triggered by a pin between two of the electrodes. Crowbar timing is insensitive to gap dimensions and to current magnitude. Pin placement is critical but little energy is dissipated in the neighborhood of the trigger pin. 7 Refs.

Primary Keywords: Triggered Spark Gap; Self-crowbarring Gap; 200 kA Peak Current; Three-electrode System; 95 nH Total Switching System Inductance

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Vacuum, Reviews; Vacuum Gaps, Reviews)

VACUUM ARCS AND SWITCHING

G.A. Farrell

General Electric Co., Schenectady, NY 12301

Proceedings Of The IEEE, Vol. 61, No. 8, pp 1113-1136 (08/1973).

This paper is a review of vacuum-arc phenomena which are related to switching devices. Despite the device overtones, the approach adopted for this paper is fundamental. Topics discussed include the drawn arc, the triggered arc, the power input to the cathode spot, cathode spot division, arc stability, substructure of the cathode spot, direct recovery processes, and breakdown between electrodes subjected to reactive arcinduced fragmentation. Reference to the recent literature is made. Due to the somewhat specialized nature of certain parts of the discussion, introductory and appendix sections of the paper present supplementary remarks on the concept of plasma and electrical conduction in gases, electron emission processes, and electrical contact phenomena. 134 Refs.

Primary Keywords: Vacuum Breakdown; Vacuum Switching; Drawn Arc; Triggered Arc; Cathode Spot; Recovery; Electrode Conditioning; Field Emission

COPYRIGHT: 1973 IEEE. REPRINTED WITH PERMISSION

(SWITCHES, CLOSING)

(Reviews)

A CRITICAL ANALYSIS AND ASSESSMENT OF HIGH POWER SWITCHES

T.R. Burkes, M.O. Hagler, M. Kristiansen, J.P. Craig, W.M. Portnoy and E.E. Kunhardt

Texas Tech University, Lubbock, TX 79409

Nuval Surface Weapons Center Final Report On Subcontract SCEEET-SP-77-20 (08/1978).

This work represents an evaluation and summary of the current state-of-the-art in pulsed power switching. Specifically, tube type switches (thyatrons, ignitrons, etc.); thyristors, transistors, special diodes, mechanical switches and various other switches are described. Their strengths and weaknesses and the switch performance achieved by series-parallel combinations of small devices is not included. A comparison of the capabilities of commercially available switches is made. Switch characterization and evaluation of those parameters responsible for switching performance, including standoff voltage, peak current, d/dt, pulse width, and pulse repetition rate, are presented. 345 Refs.

Primary Keywords: State-of-the-art; Thyatron; Ignitron; Thyristor; Transistor; Spark Gap; Mechanical Switch; Parameter Characterization

(SWITCHES, CLOSING)

(Gas Gaps, Optical)

A LASER-TRIGGERED 50 PPS HIGH-VOLTAGE SWITCH WITH NANOSECOND JITTER

A.H. Guenther and R.H. McHugh

AFWAL, Kirtland AFB, NM 87117

Proceedings Of The IEEE, Vol. 55, No. 8, pp 1504 (08/1967).

A Q-switched YAG laser system was used to switch a high-voltage spark gap at rates up to 50 pps with jitter of approximately 1 ns. 6 Refs.

Primary Keywords: Laser-triggered Spark Gap; YAG Laser; Electrode Triggering; 11-100 ns Laser Output; Megavolt Operating Voltage; Repetition

COPYRIGHT: 1967 IEEE. REPRINTED WITH PERMISSION

6054
(PULSE GENERATORS; POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, CLOSING)
(Capacitive; Pulse Transformers; Gas Gaps, Electrical; Avalanche Transistors, Electrical)

SPARK CHAMBER PULSING SYSTEM

L. Lavoie, S. Parker, C. Rey and D.M. Schwartz
University of Chicago, Chicago, IL
The Review Of Scientific Instruments, Vol. 35, No. 11, pp 1567-1571
(11/1964).

A spark chamber pulser is described in which several avalanche transistors and step-up transformer drive directly a spark gap whose trigger electrode is surrounded by barium titanate dielectric. Output pulses of from 1 to 25 kV with a risetime of 1 nsec and an output impedance of less than 1 ohm can be obtained. The total delay from the 1-V input pulse to the high voltage output pulse ranges from 17 to 65 nsec dependent on the desired voltage and the mode of operation of the spark gap. Jitter times are less than 3 nsec. When Elkanite-tipped electrodes are used, the gap life is in excess of 500000 pulses. Methods are given for reducing the delay to less than 25 nsec at 20 kV and the recovery time to less than 200 microseconds at 10 kV. 12 Refs.

Primary Keywords: Spark Chamber Pulser; 1 To 25 kV Output Pulses; <1 Ohm Output Impedance; >5 Million Pulses Gap Life; Spark Gap; Avalanche Circuit; Low Delay; Nanosecond Jitter; Elkanite Electrodes

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6055
(ENERGY STORAGE; CAPACITIVE; SWITCHES, CLOSING)

(Capacitor Banks; Gas Gaps, Electrical)
SPARK-GAP SWITCHING OF A 384-KJ LOW INDUCTANCE CAPACITOR BANK
L.M. Goldman, H.C. Pollock, J.A. Reynolds and W.F. Westendorp
General Electric Co., Schenectady, NY 12301
The Review Of Scientific Instruments, Vol. 33, No. 10, pp 1041-1044
(10/1962).

A three-electrode spark gap which can handle high energy (96 kJ) has been designed and used with a 384 kJ capacitor bank having an operating range from 30 to 60 kV. The gap jitter time has been reduced to less than 25 nsec. During the theta-pinch experiments involving 3000 discharges of the bank, there has been no significant deterioration of the gaps or variation of the electrical characteristics of the system. 10 Refs.

Primary Keywords: Spark Gap; 384 kJ Capacitor Bank; <25 nsec Gap Jitter; Low Inductance Bank; Life Test

Secondary Keywords: Theta-pinch
COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6057
(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

TRIGGERING MECHANISM OF LOW-PRESSURE SPARK GAPS

R. Hancox
Culham Lab., Abingdon, Oxfordshire, UK
The Review Of Scientific Instruments, Vol. 33, No. 11, pp 1239-1244
(11/1962).

The triggering delay in two low-pressure spark-gap switches, operating in the pressure range 1E-3 to 3E-2 mm Hg, has been measured under a wide range of conditions. When the trigger pin is in the negative electrode, the delay is found to consist of two components. The first part depends on the construction of the trigger pin, the trigger voltage, and the impedance of the trigger circuit, while the second part depends on the nature and pressure of the gas in the gap, and the voltage and impedance of the circuit being switched. If the trigger pin is in the positive electrode a further delay is added which is approximately equal to the transit time of an ion across the gap. A mechanism for the breakdown is proposed which is consistent with the measurements and with previously reported results. 3 Refs.

Primary Keywords: Spark Gap; Triggering Mechanism; Low-pressure Spark-gap; 1E-3 To 3E-2 mm Hg Pressure Range; Triggering Delay Measurement; Critical Pressure; Breakdown Modeling

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6060
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Vacuum, Electrical; Electrodes)

A MEANS OF RAISING THE THRESHOLD CURRENT FOR ANODE SPOT FORMATION IN METAL-VAPOR ARCS

J.A. Rich
General Electric Co., Schenectady, NY 12301
Proceedings Of The IEEE, Vol. 59, No. 4, pp 539-545 (04/1971).

Of the various processes occurring in an arc at high currents one of the most important with regard to application is the formation of an anode spot and the consequent melting associated with it. Vacuum arc devices depend for their operation on the formation of a high current transient metal-vapor arc. The limiting current in a particular design may be set by destructive melting at the anode. It is shown that it is possible to raise the threshold current for anode spot formation in a metal-vapor arc by suitably changing the electrode geometry. From a study of a few simple electrode geometries a set of guidelines has been evolved governing the choice of electrode geometry. As an illustration of the efficacy of these guidelines and the means of implementing them in practice it is shown how it is possible, with successive modifications of a coaxial-cylindrical electrode structure, to attain a peak current of 72 kA for a damped 60-Hz current wave without electrode melting. 5 Refs.

Primary Keywords: Vacuum Breakdown; High-current Arc; Anode Spot; Anode Melting; Operation Limitation; Electrode Geometry Selection; Design Considerations

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

6064
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Electrodes, Vacuum, Electrical)

ANODE PHENOMENA IN METAL-VAPOR ARCS AT HIGH CURRENTS
J.A. Rich, I.E. Prescott and J.D. Cobine
General Electric Co., Schenectady, NY 12301
Journal Of Applied Physics, Vol. 42, No. 2, pp 587-601 (02/1971).

The present investigation is concerned with the conditions associated with the development of an anode spot for metal-vapor (vacuum) arcs. Chief among the aims of the investigation is the determination of the threshold current density for anode-spot formation for a variety of electrode materials spanning a wide range of thermal and electrical properties. Electrodes of Sr, Al, Ag, Cu, Mo, and W were chosen for study in a plane-parallel electrode geometry. Arcing was over one-half cycle of a 60-Hz current wave. The onset of anode-spot formation was determined from high-speed streak photographs of the discharge. An oscillographic record of the arc voltage was obtained simultaneously with the streak picture. From the data obtained particular interest attaches to the threshold current for anode-spot formation, the threshold current density derived from it, and the arc voltage current characteristic. In general, high-current metal-vapor arcs have positive volt-ampere characteristics and exhibit an hysteresis effect. Rapid changes in arc voltage, noise voltage, and in the magnitude of the hysteresis effect are associated with the formation of an anode spot. The noise voltage and arc spot decrease as the spot develops. 12 Refs.

Primary Keywords: Vacuum Breakdown; Anode Spot Formation; Parallel-plane Electrodes; Voltage Variations

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6067
(SWITCHES, CLOSING)

(Lightning)

BEHAVIOR OF THE RESISTANCE IGNITOR IN MERCURY

W.H. Rigrod
Westinghouse Electric Corp., Bloomfield, NJ

Journal Of Applied Physics, Vol. 22, No. 6, pp 787-796 (06/1951).
An empirical expression has been derived for the probability of arc striking per unit time, per unit length of contact perimeter, for a resistance ignitor in a mercury-pool tube: $P = k(E/E_{\text{sat}})^{3/2} \cdot \rho^{1/2}$, where k and E_{sat} are constants, E is the "useful" electric field strength near the mercury surface, and ρ the resistivity of ignitor material at the junction with the mercury.

From this formula, a formula has been established for the probability of ignition per unit time, for the entire ignitor, in terms of the applied voltage V and ignitor firing resistance R . With this formula, whose two arbitrary constants can be determined by two sets of measurements, the firing voltage of any ignitor can be predicted under a wide variety of circuit conditions, provided R remains unchanged under these conditions. The probability formula was found to be consistent with a modification of a theory advanced by L. Tonks, whereby mercury surface distortion and rupture permit field emission at field strengths less than those effective for smooth surfaces. The modification attributes the reduction in ignitor firing voltage by ignitor current to its extremely localized ohmic heating of the mercury. This heating reduces the surface tension and roughens the mercury surface, thereby accelerating the process of surface rupture by the electric field. 12 Refs.

Primary Keywords: Ignition Switch; Ignition Characteristics; Resistance Ignition; Ignition Probability; Geometry Consideration; Empirical Formula

COPYRIGHT: 1951 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6068

(BREAKDOWN STUDIES)

(Electrodes)

CATHODE DARK SPACE AND NEGATIVE GLOW OF A MERCURY ARC

C.G. Smith
Raytheon Manufacturing Co., Newton, MA

Physical Review, Vol. 69, No. 3-4, pp 96-100 (02/1946).

Means were evolved to observe the cathode dark space of the mercury arc, the object being to measure the thickness and evaluate therefore the voltage gradient at the cathode to distinguish between field emission and absorption of electrons. A magnetic field transverse to the arc drives it in the opposite direction to the force involved. This wrong way motion made it possible to race the arc spot over liquid mercury while ions, electrons, and vapor were blown rearward. Photomicrographs showed a negative glow, its image in the mercury, and a space between; evidently twice the dark space. A one-ampere arc had a dark space of 0.001 cm; a hundred times too large for the field theory, and causing excessive space charge limitation of current unless compensating ionization occurs throughout said space. Phenomena in the negative glow must cause the field ionization and also intensive electronic bombardment of the cathode. This is assumed to cause cumulative excitation of the liquid resulting in emission of electrons and light. A continuous spectrum originates within the limits of measurement at the liquid. 12 Refs.

Primary Keywords: Mercury Arc Cathode Spot; Spot Motion; Negative Glow; 0.001 cm Cathode Dark Space; 100 V/cm; Current; Transverse Magnetic Field; Field Emission

COPYRIGHT: 1946 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

6070

(INSULATION, MATERIAL)

(Liquid)

DETERMINATION OF HIGHLY STRESSED VOLUMES IN OIL DIELECTRICS

F.W. Burke, J. Lacker and S. Palmer

Westinghouse Canada Ltd., Hamilton, Ontario, Canada

IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 3, pp 139-144 (09/1972).

The volume of oil under the highest stress has been shown to correlate well with the measured breakdown voltages of transformer oil in different electrode systems. The determination of the volume of oil that is most highly stressed in a given electrode system is not however an easy matter. It involves the location of equistress or equipotential surfaces followed by computation of the oil volume contained within the surfaces. This paper describes a differential probe and amplifier system, which has been developed to allow the direct plotting of equipotential lines on a conducting paper analog of any two-dimensional electrostatic field. 12 Refs.

Primary Keywords: Oil Insulation; Electrical Stress Calculation; Volume Effect; Several Geometries; Equipotential Surface

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

/ AC
-/-

6071
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrodes)

ELECTRON EMISSION IN INTENSE ELECTRIC FIELDS

R.H. Fowler and L. Nordheim
Proceedings Of The Royal Society Of London, Vol. A119, pp 173-181
(01/1928)

In this paper, Fowler and Nordheim build upon the accomplishments of others in an attempt to improve the theoretical exposition and the correlation with experiments in relation to the process of extracting electrons from cold metals by intense electric fields. They have included the effect of an external field and have established a formula for currents which is independent of T at low temperature and concurs with experiment. In addition, the emission coefficients for electrons of given energy in a uniform external field are calculated. It is shown for the most commonly used metals that emission should occur for fields >1E7 volts/cm. 12 Refs.

Primary Keywords: Field Emission; Thermionic Emission; Intense Electric Fields; Electron Emission; Emission Coefficients; Potential Energy Step; Theory

COPYRIGHT: 1928 ROYAL SOCIETY OF LONDON

6076
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Surface Flashover)

HIGH VOLTAGE INSULATORS FOR PARTICLE ACCELERATORS

K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Nuclear Science, Vol. NS-16, No. 3, pp 111-112
(06/1969)

In modern high energy particle accelerators there are many component parts and devices which operate at high voltages in vacuum, e.g., injectors, inflectors, beam choppers and velocity separators. Since the surface voltage stress attainable across insulators is generally lower than across plane gaps, the physical size of the apparatus is governed by the high voltage performance of the support insulators in vacuum. In this paper the author discusses the various factors affecting the insulator performance, in the light of his experience with NIPROD, the 7 BeV proton synchrotron and the design of a DC injector for an intense neutron generator machine which was under study at Chalk River, Canada. 4 Refs.

Primary Keywords: High Voltage Insulators; Insulator Flashover; Particle Accelerator; Field Emission; Insulator Charging; Gas Evolution; Breakdown Factors

COPYRIGHT: 1969 IEEE, REPRINTED WITH PERMISSION

6080
(BREAKDOWN STUDIES)
(Electrodes)

MOTION AND SPECTRUM OF ARC CATHODE SPOT IN A MAGNETIC FIELD

R.M. St. John and J.G. Winans

University of Wisconsin, Madison, WI

Physical Review, Vol. 98, No. 6, pp 1664-1671 (06/1955).

The velocity of the cathode spot of a mercury arc at the junction between solid and metal in a transverse magnetic field has been measured for magnetic field strengths between 0 and 1700 oersteds. The approximate doubling of retrograde velocity at about 11000 to 15000 oerstads was followed by an additional rapid rise of velocity at about 15000 oerstads. Spectra of the arc showed Hg II and Hg III lines at the stronger magnetic fields. Radiation from the cathode spot showed mercury lines and a continuous spectrum which is especially intense at the lines. Some Hg lines are broadened symmetrically and others asymmetrically. If the broadening is due to a Stark effect, the electric field strength in the cathode spot region is greater than 66 volts/cm. The arc mechanism previously proposed is extended to explain the rapid velocity rises with increasing magnetic field strength by associating them with the effect of Hg⁺ and Hg⁺⁺ ions. 12 Refs.

Primary Keywords: Cathode Spot Motion; Transverse Magnetic Field; >6E6 Volts/cm Electric Field Strength; Cathode Spot; Rapid Velocity Rises; Spectroscopic Diagnostic; Mercury Cathode

COPYRIGHT: 1955 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

6081
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Liquid; Electrical; Ignitrons)
ON ANCHORING THE MERCURY POOL CATHODE SPOT

L. Tonks
General Electric Co, Schenectady, NY 12301
Physics, Vol. 6, No. 9, pp 274-305 (09/1935).

This paper presents results of an experiment designed to observe the anchoring of the spot in a mercury cathode by several metals projecting through the surface of the mercury pool. Fe, Pd, Zr, Et, Cr, Cu, Ir, Mo, Ta, and W are all tried with varying results. The current in the spot is seen to have a marked effect on behavior. The spot is seen to become a fine line around the meniscus of the projection. 7 Refs.

Primary Keywords: Cathode Spot Anchoring; Cathode Line; Mercury Pool; Limited Cathode Line Length; Several Anchoring Materials

COPYRIGHT: 1935 AMERICAN PHYSICAL SOCIETY AND THE SOCIETY OF RHEOLOGY

6091
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Recovery)

THE APPLICATION OF PASCHEN'S LAW TO THE RE-IGNITION OF AN ARC

J.D. Cobine and R.B. Power

Harvard University, Cambridge, MA

Journal Of Applied Physics, Vol. 8, No. 6, pp 287-290 (06/1937).

An AC arc, in order to re-strike after passing through current zero, requires a potential considerably higher than the normal burning potential. This re-ignition potential is investigated for short gaps in nitrogen, using pure graphite electrodes with spacings up to two mm and pressures up to 50J cm Hg. The re-ignition potential is found to have two characteristics. One of these characteristics is followed for the arcs in which the cathode spot is maintained by field emission, and the other is followed for the 'thermionic' arc. Relations are obtained between this re-ignition potential and both the gas pressure and the gap spacing, with the arc current as a parameter. These relations may then be combined into a single relation between the re-ignition potential and the product of the pressure and spacing. This gives a function that is of the same form as the Paschen law for the initial sparking potential of a gap. 10 Refs.

Primary Keywords: Paschen's Law; Arc Re-Ignition; Extreme Electrode Materials; Re-Ignition Potential; Gap Separation; Gas Pressure

COPYRIGHT: 1937 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6097
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas; Electrical; Ignitrons)

THE PRODUCTION OF HIGH VELOCITY MERCURY VAPOR JETS BY SPARK DISCHARGE

J.R. Hayes

Bell Labs, Murray Hill, NJ 07974

Physical Review, Vol. 73, No. 8, pp 891-903 (04/1948).

Photographs of sparks of microsecond duration in hydrogen to a mercury electrode show high velocity jets from the mercury surface regardless of polarity. Spectroscopic examination shows that these jets are largely composed of mercury atoms which sweep away the hydrogen. Measurements of jet velocity demonstrate that it is independent of current and gas pressure over a wide range. While it decreases with distance from the source, the original velocity of the cathode jet is 1.9E5 cm/sec., and that of the anode jet is 1.5E5 cm/sec. The energy of the cathode jet can be accounted for by positive mercury ions crossing the anode gap. It appears that the energy of the cathode jet cannot be accounted for unless it is assumed that, in addition to positive ions striking the cathode and rebounding as neutral atoms, many mercury atoms leave the cathode as negative ions. 20 Refs.

Primary Keywords: Hydrogen Breakdown; Mercury Electrode; Mercury Vapor Jet; Jet Velocity; Microsecond Time Scale; Spectroscopic Diagnostic

COPYRIGHT: 1948 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

6103

(SWITCHES, CLOSING)

(Thyristors)

CATHODE-CURRENT DEPENDENCE ON PULSE WIDTH FOR HYDROGEN THYRATRONS

J.E. Croghan

ECOM, Fort Monmouth, NJ 07703

IEEE Transactions On Communications And Electronics, Vol. 83, No. 74, pp 582-585 (03/1964).

It is well known that the oxide-coated cathode in a well-activated hydrogen thyatron is capable of sustaining a current density in excess of 20 A/sq.cm. for pulse durations of 1 microsecond or less. It is also known that, as the pulse length increases, the emission density at which arcing occurs decreases. The current capabilities of oxide-coated cathodes in hydrogen thyatrtons were experimentally evaluated at pulse lengths of 5, 30, 110, and 1,000 microseconds, and a number of different tube sizes were used. At a constant pulse width of 1 microsecond the current density at which arcing occurred was related to the cathode coating resistance and the limiting factor was a maximum power-dissipation density, the power density at which arcing occurred was related to the pulse length. The use of this dependence to determine the cathode current capability at any pulse width is discussed. 1 Refs.

Primary Keywords: Cathode Effects; Long Pulse Lengths; Breakdown Voltage vs Pulse Length; Several Thyatron Sizes

COPYRIGHT: 1964 IEEE, REPRINTED WITH PERMISSION

6106

(SWITCHES, CLOSING)

(Thyristors)

DEVELOPMENT OF A HYDROGEN THYRATRON HAVING A LONG PULSE CAPABILITY

D. Dolbear (1), D. Fleischer (1), S. Marz (1), R. Plante (1), D. Turnquist (1) and N. Reinhardt (2)

(1) EG&G Inc, Salem, MA 01970

(2) Consultant, Lexington, MA

1978 IEEE Thirteenth Modulator Symposium, pp 117-124 (06/1978).

A hydrogen thyatron is being developed which is capable of switching 80 amperes at 100 kilovolts with the additional and unusual requirement that the pulse width be as long as 30 seconds with a 10 percent duty cycle. Thyatron operation under these relatively long pulse conditions at modest current levels represents a unique class of thyatron service, requiring significant departures from standard thyatron design practices. Radical departures from standard cathode design are necessary to ensure effective utilization of the cathode at the required cathode current on the long time scales involved. In addition, energy losses which occur both in the cathode plasma and at the grid structure integrate over the duration of the current pulse, and the resulting high transient heating must be considered and controlled. The need for a conservative 100-kilovolt anode holdoff capability necessitates the use of a multiple-section high voltage holdoff structure, and this need is complicated by an additional requirement that high voltage recovery be achieved within 100 microseconds. The various aspects of the overall tube design are reviewed and the design approach is discussed. Experimental results are presented and consideration is given to the external circuitry associated with the tube in its intended environment, a neutral beam beam source in a magnetic plasma confinement fusion application. 4 Refs.

Primary Keywords: Ceramic Thyatron; Long Pulse; New Cathode Design

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

6109

METAL-OXIDE DEVICES FOR RAPID HIGH CURRENT SWITCHING

G. Guile, P. Laplante, S. Levy and S. Schneider

ECOM, Fort Monmouth, NJ 07703

01/1965.

Availability: AD-A055 135/657

NIS

No abstract available.

Primary Keywords: Switching Circuits; Suppressors; Pulse Generators; High Voltage. Reprints

Secondary Keywords: Niobium Diodes, NTISDODXR

Distribution Restriction: AVAILABILITY PUB IN IEDM TECHNICAL DIGEST, P277 282 1976

6110

(SWITCHES, CLOSING)

(Thyristors)

MULTI-CIRCUIT HYDROGEN THYRATRONS WITH NANO-SECOND RISE TIMES

S. Friedman, F. Goldberg, J. Hamilton, S. Marz, P. Plante and D. Turnquist

EG&G Inc, Salem, MA 01970

1978 IEEE Thirteenth Modulator Symposium, pp 129-134 (06/1978).

A new and advanced class of high-power hydrogen thyatrtons is being developed which is capable of switching very short and ultra fast rising microsecond pulses. The effort underway is to extend the operating range of thyatrtons to values of dV/dt and current rise time on order of magnitude faster than heretofore achieved, and to do so in a thyatron-like current-voltage curves and repetition rates. Immediate applications are in pulsed power currents and repetition rates of up to 100 kHz and dV/dt of 112 A/s with a peak current of 10 kA and pulse currents of up to 75 kA, pulse repetition rates of 100 Hz and forward voltage holdoffs of 50 kV for a single section tube and up to 250 kV for a dual and quad tube. Retention of the usual advantages of thyatron switches (stable operation, fast recovery time, and long life), is realized in addition to meeting various other requirements imposed on these tubes in these applications. This paper describes some of the early work we have conducted and the progress we have made in this extremely interesting region of thyatron operation. 3 Refs.

Primary Keywords: Thyatron; Thyatron, Fast Pulse; Short Pulse; High

Potential; High Current; High Voltage Repetition Rate; Analysis Of Discharge Formation

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

6154
(BREAKDOWN STUDIES)
(Gas, Electrical)

Monte Carlo Simulation of the Low-Voltage Arc Mode in Plasma Diodes
S.N. Salinger and J.E. Rowe
University of Michigan, Ann Arbor, MI
Journal of Applied Physics, Vol. 39, No. 8, pp 3933 (07/1968).

A statistical simulation of the low-voltage arc mode of plasma diodes is carried out on a large-scale digital computer to ascertain the importance of various thermalization and transport mechanisms. The computer experiments are two-dimensional and utilize Monte Carlo techniques to study the low-voltage arc in nodes at p=2 Torr, current=5 A, and diode spacing=37 cm. Results on the potential distribution, electron-density distribution, and electron-energy density function are presented and discussed. The theoretical results are correlated with experimental results. 6 Refs.

Primary Keywords: Plasma Diode; Low Voltage Arc; Theory; Numerical Calculation; 2-d Monte Carlo Simulation

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6158
(BREAKDOWN STUDIES)
(Gas, Electrical)

PLASMA PROPERTIES OF KILDAMPERE DISCHARGES

J.E. Creadon
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions on Electron Devices, Vol. ED-15, No. 6, pp 396-402 (06/1968).

Plasma properties and characteristics that are of interest to high-current switching devices have been investigated. Peak pulse currents up to 8000 amperes have been used to generate dense plasmas in linear glass-metal diodes. Two tube diameters 3 and 7.5 inches, have been studied. In the case of the 3-inch-diameter diode, the electrode separation was varied from 10.6 to 25.1 cm. Hydrogen gas was studied in the pressure range from 0.5 to 40 Torr. Electron densities and temperatures have been determined using spectroscopic techniques. Densities were found to be in the 1E16 to 1E17 per cu.cm. range. Plasma resistivities have been determined from a knowledge of the density and temperature. The observed dependence of resistivity on current and pressure is discussed and the results are compared with resistivities obtained from tubedrop measurements. The effects of impurities and instabilities are also discussed. 8 Refs.

Primary Keywords: Hydrogen Breakdown; 80 kA Current Level; Glass-metal Diode; 5-40 Torr Pressure Range; Plasma Density; Plasma Resistivity; Impurity Effects

COPYRIGHT: 1968 IEEE, REPRINTED WITH PERMISSION

6174
(PARTICLE BEAMS, ELECTRON)
(Generation)

NANOSECOND PULSED ELECTRON ACCELERATOR

T. Yamamoto, J. Ohkuma and M. Kawanishi
Osaka University, Suita, Osaka, Japan
The Review Of Scientific Instruments, Vol. 42, No. 9, pp 1366-1367 (09/1971).

An electron accelerator that can deliver a pulsed electron beam of the shortest duration and highest energy and current possible is desirable in many fields of research, especially in studying the fast transient phenomena in radiation physics and chemistry. In general, operation of the electron beam is usually performed by supplying a pulsed gating-voltage from a coaxial line-type pulser, hand-held pulser, or pulse sharpener to the grid of the gun. A unique electron accelerator which satisfies the above mentioned conditions has been developed and the characteristic features of the device are reported in the present note. 3 Refs.

Primary Keywords: Electron Gun; Mercury Relay; Short Pulse; Low Current
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6211 ELECTROMECHANICAL PULSE GENERATORS

E. Levi
Polytechnic Institute of New York, Brooklyn, NY 11201
Research rept. No. R-751-59, 40p (07/1959).
Availability: AD-220 852/85T
NTIS

No abstract available.

Primary Keywords: Electromechanical Converters; Pulse Generators; Design; Radar, Thermonuclear Reactors

Secondary Keywords: NTISDDX

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE

6288 (PULSE GENERATORS; PULSE GENERATORS; PULSE GENERATORS)

(LC; Spiral; Stacked Line)

NOVEL PRINCIPLE OF TRANSIENT HIGH-VOLTAGE GENERATION

R.A. Fitch (1) and V.T.S. Howell (2)

(1) United Kingdom Atomic Energy Authority

(2) Bonar, Long Electronics Ltd.

Proceedings Of The IEE, Vol. 111, No. 4, pp 849-855 (04/1964).

The authors discuss a class of pulse generator in which several sections are charged to opposite polarity to produce a net voltage of zero. The sections are then discharged in series such that the inherent delays effect a voltage reversal in one-half of sections to provide voltage multiplication. This method of multiplication is termed voltage inversion by the authors. Stacked-line, LC, and spiral generators are discussed as members of this class of generator. 3 Refs.

Primary Keywords: Voltage Inversion Pulse Generator; Voltage Multiplication; Stacked-line Pulse Generator; LC Pulse Generator; Spiral Pulse Generator

COPYRIGHT: 1964 IEE

6297 (BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)

THE INFLUENCE OF DISSOLVED GASES ON THE ELECTRIC STRENGTH OF N-HEXANE
A.M. Sletten and T.J. Lewis
Queen Mary College, London, UK

British Journal of Applied Physics, Vol. 14, pp 883-888 (12/1963).

The electric strength of n-hexane for steady fields (direct strength) is found to increase from 0.7 MV/cm. and to become insensitive to the electrode material as the amount of dissolved oxygen is increased to an equilibrium partial pressure of 100 mmHg in the vapour phase above the liquid. Greater amounts do not increase the strength. Nitrogen, hydrogen and carbon dioxide have no effect even when large amounts are dissolved, except that repeated discharges when carbon dioxide is present cause the strength to rise, probably because of the release of oxygen. Unless the liquid has been pre-stressed with direct voltage of opposite polarity, the strength with 1.5 microsecond pulses is not affected by dissolved gas. Immediately after pre-stressing, however, the strength with pulses may be as great as 2.5 MV/cm. Dust particles of the order of 1 micron in size are always observed in the liquid and under direct stress pass to and fro between the electrodes. This activity is reduced by the addition of oxygen. With high oxygen concentrations the visible particles are sometimes observed to be expelled from the gap and strengths up to 2 MV/cm. are then recorded. Oxygen, being electronegative, is likely to cause the formation of negative ions. It is suggested that these ions can inhibit the breakdown and lead to higher strengths than the direct voltage and also with pulses if the liquid has been previously stressed with direct voltage of opposite polarity. 19 Refs.

Primary Keywords: N-hexane; Dissolved Gas; Oxygen Gas; Increased Dielectric Strength; Several Gases; No Effect; Dust Particles

COPYRIGHT: 1963 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6319 (BREAKDOWN STUDIES)
(Gas, Electrical)

THE STEP VOLTAGE DROP ACROSS A SPARK WITH A PULSE DISCHARGE IN THE NANOSECOND RANGE

L.G. Bychkova, Yu.I. Bychkov and G.A. Matsis
Soviet Physics Journal, Vol. 10, No. 12, pp 75 (12/1967).

The step voltage drop across a spark when there is a static breakdown was first observed by Popowski and his colleagues. A survey of the work on the voltage steps of sparks in gases with a static breakdown for values of E/P < 100 V/cm Torr is given. The cause of this phenomenon has not been definitely established, so that interest in its study continues. Most authors connect the presence of steps with transition from a Townsend type of discharge to a streamer type. 5 Refs.

Primary Keywords: Townsend Discharge; Streamer Breakdown; Discontinuous Voltage Drop; UV Radiation

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

6322 (ENERGY STORAGE)

(System Protection)

ENERGY CONTROL FOR MICROWAVE AMPLIFIER ARRAYS

G.W. Taylor and S. Schneider
ECOM, Fort Monmouth, NJ 07703

IEEE Transactions On Aerospace And Electronic Systems, Vol. AES-4, No. 5, pp 659-664 (09/1968).

In large systems using microwave amplifier arrays, the size, weight, and cost of individual energy sources require consideration of the use of a common power supply and energy storage bank. Complex energy control techniques may be necessary to protect the RF amplifiers and to provide protection for the failed amplifier from the common energy source. Four approaches are discussed. Three of these are dependent on either the development of reliable arc-free microwave switches or special isolator tubes, gas or vacuum types. A practical circuit using available components is suggested. Its advantages and limitations are discussed. Calculations are presented showing this approach can result in increased system efficiency, improved regulation, and large decreases in the size of the secondary capacitance bank for each microwave amplifier. 3 Refs.

Primary Keywords: Amplifier Array; Common Power Supply; Fault Protection; Efficiency Considerations; Voltage Regulation

COPYRIGHT: 1968 IEEE, REPRINTED WITH PERMISSION

6336 (BREAKDOWN STUDIES)

(Gas, Electrical)

INFLUENCE OF HYDROGEN ON MULTIPLE-ELECTRODE (VACUUM) GAP CHARACTERISTICS

S. Schneider, A.J. Buffa and J.E. Creadon

ECOM, Fort Monmouth, NJ 07703

Journal of Applied Physics, Vol. 40, No. 1, pp 424-425 (01/1969).

The influence of a low pressure of hydrogen on the voltage hold off and breakdown characteristics of a multiple-electrode triggered vacuum gap has been investigated. The tube is designed for 300 kV operation. The tube characteristics were studied under vacuum and at several hydrogen fill pressures at voltages from 10-300 kV. 1 Ref.

Primary Keywords: Vacuum Breakdown; Effect of Hydrogen Gas; Current Measurement; Voltage Measure; Variable Hydrogen Pressure

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6362 (DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

A NANOSECOND RISETIME MEGAVOLT VOLTAGE DIVIDER

D.G. Hollinen and S. Heurlin

Physics International Co., San Leandro, CA 94577

The Review Of Scientific Instruments, Vol. 42, No. 6, pp 824-891 (06/1971).

A small linear resistive voltage divider has been used in vacuo for measuring pulsed voltages exceeding 1 MV on electron accelerators. The monitor appears to be linear until breakdown and has a bandwidth greater than 60 Hz/15 MHz. A method of correcting for nonconservative induced potentials is described as well as several independent calibration methods. 4 Refs.

Primary Keywords: Resistive Voltage Divider; Vacuum Environment; 150 MHz Bandwidth; Calibration Consideration; Nonconservative Induced Potential

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6353
(POWER CONDITIONING; SWITCHES, CLOSING; SWITCHES, OPENING)
(Metal Oxide Switches; Miscellaneous Solid State; Miscellaneous Solid State)

PULSE SHARPENING WITH METAL-OXIDE BULK SWITCHING DEVICES

G.K. Gaulo, P.R. LaPlante, S. Levy and S. Schneider

1976 IEEE Pulsed Power Conference Proceedings, Paper IC-6 (11/1976).

Certain niobium oxide ($NbO_{2+\delta}$, δ approximately 2) materials are near insulating at room temperature but undergo an insulator-metal transition near 800 Deg.C. A similar transition can be initiated at room temperature by applying an electric field exceeding the "threshold" value which depends on the oxygen concentration (δ) of the $NbO_{2+\delta}$. Metal-oxide threshold switch (MOTS) prototypes are obtained by applying appropriate contacts and packaging. Threshold voltages range from 100 V to several kV and typical MOTS has a surge current capability exceeding 100 A, an off-state capacitance of only a few pF, and a switch delay of less than 0.5 ns. The latter two characteristics make the MOTS potentially superior to conventional devices for a number of high-speed, high-current switching functions. In particular, insertion of a MOTS into the output circuit of a conventional pulse generator can "sharpen" the leading edge of the pulse to yield a ns or even sub-ns rise time. 6 Refs.

Primary Keywords: Metal-oxide Bulk Switching Device; Pulse Sharpening; Fast Closing; Low Current; Switching Threshold

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6368
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)

TRIGGERED VACUUM GAPS

J.M. Lafferty

General Electric Co., Schenectady, NY 12301

Proceedings Of The IEEE, Vol. 54, No. 1, pp 23-32 (01/1966).

Characteristics of a sealed vacuum gap are described and the difficulties encountered in applying this gap as an overvoltage protection device are discussed. It is shown how these difficulties can be alleviated by the use of gas-free electrode materials and by triggering the gap when breakdown is required. Several methods of triggering are discussed and some practical triggering devices are described that inject minute quantities of ionized hydrogen into the gap. The hydrogen is eventually recovered by the use of a titanium hydride getter. It is shown that breakdown of the gap can be accomplished in less than one-tenth microsecond by first producing a glow discharge that is rapidly transformed into a metal-vapor arc. Properties of the metal-vapor arc are described which have an effect on the characteristics of the vacuum gap. A number of practical sealed-off triggered vacuum gaps are illustrated. These are used to carry microsecond capacitor discharge currents and 60-cycle power line currents for 1/2 cycle. The operating voltage range is from a few hundred volts to 100 kV. The advantages of vacuum gaps over gas-filled gaps are given and a number of overvoltage protection and switching applications are listed. 29 Refs.

Primary Keywords: Overvoltage Protection; Electrode Effects; Several Triggering Methods; Plasma Gun Trigger; Practical Consideration

COPYRIGHT: 1966 IEEE, REPRINTED WITH PERMISSION

6376
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

A SIMPLE SWITCHING SYSTEM FOR REPEATABLE PULSED DISCHARGES

F.L. Curzon (1) and K. Dimoff (2)

(1) University of British Columbia, Vancouver, British Columbia, Canada
(2) University of Alberta, Edmonton, Alberta, Canada

Journal Of Physics E: Scientific Instruments, Vol. 3, pp 153-154 (02/1970).

A switching system has been designed to operate on an overall jitter of 0.2 microsec in current breakdown for a 5.7 kJ pulsed discharge. Reproducibility can be sustained for up to 70 consecutive firings. Consisting of two inexpensive open air spark gaps built from readily available materials, the system functions reliably with a minimum of maintenance. 2 Refs.

Primary Keywords: Triatron Gap; Good Reproducibility; Brass Electrodes; Atmospheric Air Gap

COPYRIGHT: 1970 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6432
(PARTICLE BEAMS, ELECTRON)
(Generation)

INTENSE ELECTRON-BEAM PINCH FORMATION AND PROPAGATION IN ROD PINCH DIODES

R.A. Maheffey, J. Golden, S.A. Goldstein and G. Cooperstein

Naval Research Lab., Washington, DC 20375

Applied Physics Letters, Vol. 33, No. 9, pp 795-797 (11/1978).

Intense electron-beam pinches are formed and propagated at moderate impedance (5-25 ohm), using rod-shaped diodes. Pinch propagation of up to 20 cm with 45% efficiency and ion-generation efficiency $\geq 15\%$ has been observed. 16 Refs.

Primary Keywords: Intense Electron-beam Pinches; 5-25 Ohm Impedances; Rod Pinch Diodes; 20 cm Pinch Propagation; 20 cm/s Pinch Velocity; Diode Damage; Ion Formation

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6633
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)

LIMITING CAPABILITIES OF A PLANAR EXPLOSIVE MAGNETIC GENERATOR AS A PULSED ENERGY SOURCE

L.S. Gerassimov and V.I. Ikravennikov

Soviet Physics-Technical Physics, Vol. 24, No. 7, pp 841-844 (07/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1513-1519 (July 1979). The limiting capabilities of a planar explosive magnetic generator are studied: the voltage, the power, and the energy for operation with inductive and resistive loads. The possibility of constructing module and cascade explosive systems with energies up to 100 MJ is studied. A corresponding calculation method is proposed. The theory is compared with experiment. 10 Refs.

Primary Keywords: Flux Compression Generator; Resistive Load; Inductive Load; Modular Approach; 100 MJ Output; Analysis

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6436
(BREAKDOWN STUDIES)
(Surface Flashover)

SURFACE BREAKDOWN OF A SOLID DIELECTRIC IN VACUUM. III. QUANTITATIVE MODEL

A.A. Avdienko and M.D. Malev

Institute Of Nuclear Physics, Academy of Sciences of the USSR,

Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 24, No. 5, pp 581-587 (05/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 987-998 (May 1979). A method is described for the analysis of surface breakdowns. This

method is based on a desorption model proposed earlier. The dielectric strength calculated as a function of the length of the insulator and the angle between its surface and the field direction agreed with experimental data reported by various workers. The role played by surface charge is evaluated. Methods are discussed for increasing the dielectric strength of insulators in vacuum. It is shown that the surface form of the material breakdown can occur in a dielectric with a relatively high conductivity (σ less than or approximately equal to $10^{-3} \text{ ohm}^{-1} \text{ cm}^{-2}$). The characteristics of this breakdown are described. 25 Refs.

Primary Keywords: Surface Flashover; Desorption Model; Dielectric Strength vs Insulator Length; Surface Charge; Thermal Breakdown

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6438
(PULSE GENERATORS)
(Systems)

A GENERATOR OF POWERFUL PULSES OF COMPLEX SHAPE

A.A. Egorov, V.S. Penayuk, L.I. Yudin and G.N. Ostreiko

Institute of Nuclear Physics, Academy of Sciences of the USSR,

Novosibirsk, USSR

Instruments And Experimental Techniques, No. 5, pp 1183-1186 (10/1966).

Trans. From: Pribory i Tekhnika Eksperimenta 5, 156-159 (September-October 1966).

A multicell thyatron generator of electric pulses of complex shape is described. Each section of the pulse can be independently controlled both in shape and amplitude. The design principle of such a generator is related to the task of obtaining millisecond pulses with a current amplitude of hundreds and thousands of amperes. The generator can be most profitably used for the production of large-amplitude current pulses of prescribed shape in various types of coils. In the majority of practical cases the generator makes it possible to reproduce a prescribed law of current variation. 2 Refs.

Primary Keywords: Pulse Generation System; Variable Pulse Shape; Self-Induced Independent Sections; Millisecond Pulse Width; 100 KA Pulse Amplitude

COPYRIGHT: 1966 PLenum Press, REPRINTED WITH PERMISSION

6441
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Liquid, Electrical; Liquid)

AN INVESTIGATION OF THE ELECTRIC STRENGTH OF SOME LIQUID DIELECTRICS SUBJECT TO NANOSECOND VOLTAGE PULSES

N.S. Rudenko and V.I. Tsvetkov

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics-Technical Physics, Vol. 10, No. 10, pp 1417-1419 (10/1965).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1849-1853 (October 1965).

Experimental tests of the electric strength of transformer oil, doubly distilled water, and process water subject to nanosecond voltage pulses are described for sample thickness of 50, 100, 200, and 500 microns. The function $E/\text{sub b}^2 = f(t/\text{sub d}^2)$ ($E/\text{sub b}$ is the electric field strength at breakdown, and $t/\text{sub d}$ is the discharge time) can be explained under the assumption that the discharge is electronic. The results of the experiments yield the significant conclusion that water can be used as an insulator in high-voltage nanosecond devices; it is at least as good as transformer oil. 4 Refs.

Primary Keywords: Liquid Insulation; Transformer Oil; Water; Thin Specimen Thickness; Breakdown Voltage Measurement; Comparison Of Results

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6443
(PARTICLE BEAMS, ELECTRON)
(Generation)

CERTAIN CHARACTERISTICS OF COLD CATHODES

I.Z. Gleizer and V.V. Okulov

Tomsk Polytechnic Institute, Tomsk, USSR

Instruments And Experimental Techniques, Vol. 16, No. 4, pp 1214-1215 (10/1973).

Trans. From: Pribory i Tekhnika Eksperimenta 4, 196-197 (July-August 1973).

The procedure is described and results are presented for an investigation of the emission capacity and stability of the current from various cold cathodes. The service life of a multitemitter cathode with 2000 points and a working-surface diameter of 9 mm is determined. For a diode voltage of 130 kV and a pulse length of 15 nsec the average current in the cathode was 430 A for a relative mean square scatter of 4%. After 100 pulses the cathode characteristics did not change. 4 Refs.

Primary Keywords: Field Emission Diode; Multitemitter Cathode; Life Test; 130 KV Operating Voltage; 430 A Current

COPYRIGHT: 1974 PLenum Press, REPRINTED WITH PERMISSION

6447
(PARTICLE BEAMS, ION)

(Generation)

COLLECTIVE ACCELERATION OF IONS IN RELATIVISTIC ELECTRON BEAMS

V.M. Bystritskii, V.I. Podkatov, A.G. Sterligov, G.E. Remnev and Yu.P.

Dun'ev

Soviet Physics-Technical Physics, Vol. 2, No. 1, pp 30-32 (01/1976).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 2, 80-84 (January 1976).

The model advanced of a two-dimensional stationary well formed behind the anode of a nanosecond accelerator, as well as the results of recent investigations on ion acceleration in a relativistic electron beam (REB), indicate a threshold injection current $I/\text{sub th}$ below which ion acceleration is not observed. To obtain additional data on this processes connected with acceleration of ions in REB we have conducted the following experiments. In the first group of experiments we used the threshold values of the injection current for several diameters of the drift tubes (70 and 90 mm). As rule, the ion pulses with amplitude above the electromagnetic-coupling level ($\geq 10 \text{ V}$) appear at values of the injection current larger than $(1.3-1.4) I/\text{sub th}$. In the second group of experiments we investigate the efficiency of ion acceleration as a function of the pressure of the gas filling the drift tube. 9 Refs.

Primary Keywords: Collective Acceleration; Relativistic Electron Beam; High Incident Current Range; Threshold Current; Ion Generation On Efficiency

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6448
(PARTICLE BEAMS, ION)
(Generation)
COLLECTIVE ION ACCELERATION BY A HIGH-CURRENT RELATIVISTIC ELECTRON BEAM
V.I. Kucherov
Gorkii Polytechnic Institute, USSR
Soviet Physics-Techical Physics, Vol. 20, No. 6, pp 817-819 (12/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1307-1310 (June 1975).
Two-dimensional ion acceleration by the quasistatic field of a high-current relativistic beam moving with respect to the ion in a strong external magnetic field is studied analytically and numerically. The accelerating and focusing fields are found as functions of the beam current. The maximum energy and density of the accelerated ions are evaluated. 12 Refs.
Primary Keywords: Collective Acceleration; External Magnetic Field; Beam Focusing; Theory; Analytical Calculation; Numerical Calculation; Energy Density Calculation
COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6449
(PARTICLE BEAMS, ELECTRON)
(Generation)
COMPUTATION OF THE ELECTRIC FIELD AT MULTIPONT CATHODES
S.Ya. Belomystev, S.F. Bugayev, V.P. Il'lin, E.A. Litvinov and G.A. Mesyats
Institute Of Atmospheric Optics, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Physics Journal, Vol. 18, No. 11, pp 1622-1623 (11/1975).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii: fizika 18, 162-163 (November 1975).

Ribbon electron beams with cross-sectional areas of 10^{-2} to 10^{-3} sq.cm. are now used in powerful electron ionization gas lasers. Such beams are produced using multipoint cold cathodes with explosive emission of electrons. The explosion of the tips of the points does not take place simultaneously with application of the voltage, but after some time called the delay time t_{delay} . To obtain a rectangular current pulse it is necessary that the t_{delay}/d for most of the peaks should be comparable to the risetime of the voltage front ($t_{\text{delay}}/d \ll t_{\text{rise}}$). 3 Refs.

Primary Keywords: E-beam Generation; Multipoint Cathode; Rectangular Beam Pulse; Theory; Numerical Calculation; E-field Calculation; Analytical Formula

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6450
(PULSE GENERATORS)
(Current)
CURRENT PULSE GENERATOR
B.F. Savchenko, A.V. Il'lin, V.N. Pakin, A.P. Panov and G.I. Sil'vestrov
Institute Of Nuclear Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Instruments And Experimental Techniques, No. 5, pp 1113-1117 (10/1968).
Trans. From: Pribyr'i i Tekhnika Eksperimenta 5, 96-100 (September-October 1968).

A generator producing on an inductive load of approximately 10^{-7} H current pulses with a flat peak with an amplitude to 200 kA at a pulse duration of 130 microseconds is described. Problems of commutation, design of pulse transformers, method of effective shaping of a flat peak, and stabilization of pulsed current within approximately $\pm 0.1\%$ at a pulse repetition frequency of up to 5 Hz are examined. Experimental data are given on the use of TGII-2500/35 pulsed thyatrons in non-standard regimes of switching current pulses with a duration of 100-300 microseconds. 4 Refs.

Primary Keywords: Constant-current Pulse; Inductive Load; 130 Microsecond Duration; Pulse Transformer; Good Repetability; Re-rated

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

6451
(PULSE GENERATORS; SWITCHES, CLOSING)
(Capacitive; Gas Gaps, Optical)
DRIVEN HIGH-VOLTAGE NANOSECOND PULSE GENERATOR TRIGGERED BY LASER RADIATION
V.Yu. Petrun'kin, L.N. Pakhomov and P.A. Andreev
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 15, No. 2, pp 515-517 (04/1972).
Trans. From: Pribyr'i i Tekhnika Eksperimenta 2, 178-180 (March-April 1972).

A high-voltage pulse generator (amplitude 30 kV) is described which is triggered by laser radiation. The generator is distinguished by a high repetition rate, the magnitude of the triggering light energy (not exceeding 10^{-3} J), a short operating delay (approximately 40 nsec), and a pulse leading-edge duration < 1.5 nsec. A generator construction is presented which allows the shaping of several synchronous high-voltage pulses obtained in various channels. 6 Refs.
Primary Keywords: Nd-glass Laser; Steel Electrodes; Strip Line Configuration; Nanosecond Rise Time; Four-pulse Output

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

6452
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRON ENERGY SPECTRUM IN HIGH-ENERGY NANOSECOND ACCELERATORS
V.V. Kremnev, G.A. Mesyats and V.P. Reznikov
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 19, No. 10, pp 1342-1344 (10/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 2168-2173 (October 1974).

The effects of matching the storage line to the diode, the switching time, and circuit inductance on the electron energy spectrum of an accelerator beam are considered. The spectrum is analyzed for a linear load, a diode with a field emission cathode, a diode with a thermionic cathode (three-halves law) and a diode with explosive electron emission. Relationships are obtained for the electron emission characteristics for the minimum electron energy in the beam. Equations are derived for estimating the effects on the energy spectrum of the electron beam of movement of the plasma front in a diode with explosive emission and of retardation in a foil at the diode output. 4 Refs.

Primary Keywords: E-beam Generation; Thermionic Emission Diode; Field Emission Diode; Storage Line; Impedance Matching; Switching Time; Inductance; Effect On Beam; Explosive Emission

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6453
(PARTICLE BEAMS, ELECTRON)
(Generation)
EMISSION OF ELECTRONS FROM THE PLASMA OF AN UNCOMPLETED DISCHARGE ALONG A DIELECTRIC IN A VACUUM
S.P. Bugayev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics Doklady, Vol. 16, No. 1, pp 41-43 (07/1971).

Trans. From: Doklady Akademii Nauk SSSR 196, 324-328 (January 1971).
The discharge current in an uncompleted discharge along a dielectric in a vacuum increases with increasing voltage V and sub D/V of the dielectric other conditions remaining equal. Therefore we investigated the emission of electrons from the plasma of the discharge along a surface of barium titanate (BaTiO_3) having $\epsilon = 3500$. A disk made of BaTiO_3 and having a thickness 0.2 mm was mounted in a vacuum chamber. A layer of silver having a point radius approximately 25 micron was pressed against the other side. The removal of electrons from the plasma was carried out by means of an extractor. Voltage pulses ranging from 0.4 to 2.4; 4; 8; 20; 50 nsec were applied between the electrodes. 8 Refs.

Primary Keywords: E-beam Generation; Dielectric Surface Flashover; Effect Of Insulator Dielectric Constant; Threshold Voltage

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6454
(PARTICLE BEAMS, ION)
(Generation)
EXPERIMENTS ON ACCELERATION OF DEUTERONS AND PROTONS IN AN ELECTRON BEAM PASSING THROUGH A GAS
A.A. Volomenskiy, V.M. Likhachev, I.V. Siniil'shchikova, O.A. Smir and V.N. Lebedev
Physics Institute, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Physics JETP, Vol. 41, No. 1, pp 26-27 (01/1975).
Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 68, 51-55 (January 1975).

We have carried out experiments on acceleration of deuterons and protons on passage of a high-current electron beam through a low pressure gas at $n\mu\text{g/cm}^3 = 0.37$. For an electron energy of 700 keV the maximum energy of the acceleration deuterons and protons exceeds 2 MeV. The total number of accelerated particles in a pulse reaches approximately 10^{12} . 10 Refs.

Primary Keywords: Collective Acceleration; High Beam Energy; Low Beam Current; Several Diagnostics Techniques

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6455
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT CAVITY ELECTRON ACCELERATOR

D.V. Iremashvili, M.I. Leont'ev and A.A. Plyutto
Sukhumi Physotechnical Institute, Sukhumi, USSR
Instruments And Experimental Techniques, No. 2, pp 261-266 (04/1967).
Trans. From: Pribyr'i i Tekhnika Eksperimenta 2, 35-40 (March-April 1967).

The operating principle of a pulsed high-current electron accelerator with the following parameters is described: accelerating potential 1-1.5 MV, electron current up to 10^3 A in a pulse with a duration of approximately 70 nsec. The frequency of the operating cycles is 1-5 Hz. The designs of the cavity resonator and spark source are given, along with their basic characteristics. 5 Refs.

Primary Keywords: Resonant Cavity Accelerator; Design Considerations; 1-MV Accelerating Potential; 1 KA Current; Spark Source; Rep-rated

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

6456
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
INVESTIGATION OF THE TIME CHARACTERISTICS OF THE TRANSITION OF FIELD EMISSION TO A VACUUM ARC
G.K. Kartsev, G.A. Mesyats, D.I. Proskurovskii, V.P. Rotstein and G.N. Fursev
A.I. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics Doklady, Vol. 15, No. 4, pp 475-477 (11/1970).

Trans. From: Doklady Akademii Nauk SSSR 192, 309-312 (May 1970).
It was of interest to investigate the transition of emitters at much higher field current densities than previously done and to investigate thoroughly the change in current from the start of explosion to complete occupation of the gap by plasma. An increase in current density leads to a reduction of the time before explosion and, hence, to obtain maximum current densities ($> 10^9$ A/sq.cm.) we used voltage pulses with a rise time t_{rise} approximately 10^{-9} sec and a length L/t_{rise} of 5 nsec to 4 microseconds. The circuit of the pulse generator was described previously. The current flowing through the vacuum gap was measured at different stages with a resolution of not more than 10^{-2} sec. The sensitivity of current measurement was 7×10^{-2} A. 15 Refs.

Primary Keywords: Vacuum Breakdown; Arc Transition; Single Crystal Tungsten Cathode; Cathode Explosion; Comparison With Exploding Wires

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6457
(PARTICLE BEAMS, ELECTRON)
(Generation)

MULTIELEMENT ACCELERATORS BASED ON RADIAL LINES
A.I. Pavlovskii, V.S. Bosomykin, G.D. Kuleshov, A.I. Gerasimov, V.A. Terenetskii and A.P. Klement'ev
Soviet Physics Doklady, Vol. 20, No. 6, pp 441-443 (06/1975).

Trans. From: Doklady Akademii Nauk SSSR 222, 817-820 (June 1975).
For several years the authors have been carrying out investigations on high-current pulsed electron accelerators based on radial lines which allow the realization of cylindrical accumulation and acceleration of charged particles. The main problem is to determine the limiting values of the electric and magnetic fields which are attained in such devices. In many important practical cases the pulse length and the magnitude of the working voltage are stipulated. With allowance for the dielectric strength of the dielectrics which are used, these conditions uniquely determine the upper limits of the energy-source power. One of the methods for achieving a further increase in the power of high-current accelerators and other installations in which a high density of the electromagnetic energy flux is required involves the use of a large number of radial lines, which are connected in series, in parallel, or in a mixed manner, depending on the required amplitudes of the current and the voltage. 5 Refs.

Primary Keywords: Radial Lines; Accelerator; Insulation Considerations; 1-MV Accelerator

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6469

(BREAKDOWN STUDIES)

(Gas, E-beam)
NONINDEPENDENT PULSED ATMOSPHERIC PRESSURE DISCHARGE SUSTAINED BY A HIGH-ENERGY ELECTRON BEAM LASTING 100 MICROSECONDS
Yu.I. Vychkov, S.A. Genkin, Yu.D. Korolev, G.A. Mesyats, V.G. Rabotkin
and G. P. Tsvetkov
Institut Of Atmospheric Optics, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Physics Journal, Vol. 18, No. 11, pp 1618-1619 (11/1973).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 18,
159-160 (November 1973).

The use of a high-energy electron beam for ionizing a gas is an effective method of exciting high-pressure space discharges. The use of comparatively weak beams substantially increases the duration of such discharges and allows us to obtain stationary combustion conditions for weak electric fields that obviously insure that the discharge will be nonindependent. However, in this case the selection of conditions for maximal energy influx into the space discharge involves theoretical questions. The problem of how to increase the input energy while maintaining the stability of the discharge will be considered in the present work. An instrument similar to that described previously was used to excite an atmospheric pressure discharge in $\text{CO}_2/\text{N}_2/2\%$ mixtures. The duration of the pulsed beam current was 10^{-4} sec. Electrons were injected through the gas discharge gap cathode over an area of 6×6 cm. Interelectrode distance d was 6 cm. The energy scattered in the gas was determined from oscilloscopes as well as from readings of an electrostatic kilovoltmeter, which was connected in parallel to the gap and a cell-charged capacitance. The capacitance was selected as sufficiently high in order to insure that the electric field would be constant during the pulse. 7 Refs.

Primary Keywords: Atmospheric Pressure Discharge; High-energy Electron Beam; E-beam Excited Discharge; 10^{-4} sec Beam Current Duration; Nonindependent Discharge; Discharge Stability; Nonuniform Ionization

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

6470

(POWER TRANSMISSION)

(Contacts)

REMOTELY CONTROLLED CONTACTS CARRYING MEGAAMPERE CURRENTS

G.S. Vil'yavtov, V.N. Karasyuk and G.I. Sil'vestrov
Nuclear Physics Institute, Academy of Sciences of the USSR,
Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 21, No. 4, pp 980-982
(08/1978).
Trans. From: Pribyti i Tekhnika Eksperimenta 6, 128-130 (July-August 1978).

The construction and the manufacturing technology is described of annular hydraulic contact clamps. Results are presented of lifetime tests at a current of approximately 1 MA made on clamps with diameters of 80-170 mm. 3 Refs.

Primary Keywords: High Current Contact; Hydraulic Closing; 1 MA Current Capability; High Reliability

COPYRIGHT: 1978 PLENUM PRESS, REPRINTED WITH PERMISSION

6471

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

REPRODUCIBILITY OF DELAY TIME FOR BREAKDOWN OF HIGH-PRESSURE TRIGGERED SPARK GAPS

G.S. Korshunov, H.S. Rudenko and V.I. Tsvetkov
Soviet Physics-Technical Physics, Vol. 14, No. 8, pp 1074-1078
(02/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1430-1436 (August 1969)

Results are given of studies of breakdown delay time of high-pressure ($p = 1$ to 15 atm) triggered spark gaps in the nanosecond range with positive and negative pulses, both with and without irradiation of the spark gap. The results were made with pulse amplitudes of 100 to 500 kV with 2 nsec front. Two variants of irradiation were used. Prior irradiation did not improve stability. High stability is obtained by irradiating the gap at the time the trigger pulse is applied ($t_{\text{tr}}/27 + 0.5 \text{ nsec}$, $t_{\text{tr}}/29 + 0.3 \text{ nsec}$). It is shown that cathode irradiation plays the major part, mainly by causing electron emission from the cathode. Photoionization of gas in the discharge gap is not important. Recommendations are given concerning the construction of high-stability trigger gaps operating at hundreds of kilovolts in the nanosecond time range. 11 Refs.

Primary Keywords: Spark Gap; Delay Measurement; 1-15 atm Pressure Range; Bipolar Trigger Pulses; Gap Irradiation; Cathode Effects

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6472

(PARTICLE BEAMS, ELECTRON)

(Generation)

SELF-ACCELERATION OF AN ELECTRON BEAM IN A GYROTROPIC MEDIUM

N.M. Masanov and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR,
Khar'kov, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 7, pp 932-935 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1676-1681 (July 1975).

In a theoretical study of the excitation of electromagnetic fields by an electron beam passing through a longitudinally magnetized ferrite calculations are carried out for two cases: the of an infinite gyrotropic medium and that of a waveguide partially filled with a ferrite. After the front of the beam pulse passes, a longitudinal electric field arises as a result of the precession of the magnetic moment of the ferrite. This electric field accelerates part of the beam. 4 Refs.

Primary Keywords: E-beam Acceleration; Gyrotropic Medium; Ferrite-filled Waveguide; Magnetic Moment Precession

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6480

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

SPARK CURRENT AND VOLTAGE IN NANOSECOND BREAKDOWN OF A GAS GAP

G.A. Mesyats, V.V. Kremnev, G.S. Korshunov and Yu.B. Yankelovich
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 1, pp 49-53 (07/1969).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 75-81 (January 1969).
Current and voltage across a spark gap in a pulsed breakdown in air were calculated as time-dependent variables, with the resistance of the discharge circuit and the capacitance of the spark gap taken into account. The current in the spark gap was assumed to be controlled by avalanche electrons. Excellent agreement between theoretical and experimental curves was obtained at spark gap overvoltage levels. A simple equation is proposed for calculating the maximum slope of voltage decay across the spark gap ignoring gap capacitance. The condition under which this equation is valid is specified. The effect of increased rate of gap voltage decay with increased interelectrode capacitance is demonstrated. 11 Refs.

Primary Keywords: Gas Spark Gap; Air Gap; Current Measurement; Voltage Measurement; Experiment; Theory; Good Agreement; Analytical Formula

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6485

(PARTICLE BEAMS, ELECTRON)

(Generation)

THE EMISSION OF OXIDE CATHODES IN A STRONG LONGITUDINAL MAGNETIC FIELD

S. Rutshteyn
Radio Engineering And Electronics Physics, Vol. 16, No. 4, pp 710-712
(04/1971).
Trans. From: Radiotekhnika i Elektronika 16, 648-650 (April 1971).

The authors theorize that the discrepancy between experimental and theoretical values of the electron emission of an oxide cathode is due to the porosity of the oxide coating. This porosity of the coating allows electrons to be emitted from the base of oxide particles, which increases the total emitting surface. To test this theory, the emission of an oxide cathode is measured with and without a longitudinal magnetic field. Emission is found to be reduced significantly for large currents, which supports the hypothesis that oxide porosity effects are important. 5 Refs.

Primary Keywords: E-beam Generation; Thermionic Cathode; Oxide Cathode; Longitudinal Magnetic Field; Reduced Emission; Area Effects

COPYRIGHT: 1971 SCRIPTA PUBLISHING CO.

6489

(PULSE GENERATORS)

(Pulse Forming Lines)

IMPROVEMENTS ON TRANSMISSION-LINE PULSERS

R.E. Dollinger, C.P. Scheffler and D.A. Moll
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Transactions On Electron Devices, Vol. ED-26, No. 10 pp 1551-1553
(10/1979).

A series of pulsers operating up to 100 kW with efficiencies up to 80 percent have been built. The voltage levels, rise times, durations, and repetition rates have been investigated for pulsers operating into different loads. The difficulties of mechanical and solid-state switching (e.g., contact erosion, sticking, and bouncing contacts), have been eliminated by using a stream of mercury droplets to bridge the gap between two switch electrodes in order to discharge a transmission line into a load or by discharging charged mercury droplets into the load. 9 Refs.

Primary Keywords: Pulse Generator; Fast Rise; Low Impedance; Rep-rate

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

6491

(PULSE GENERATORS)

(Trigger)

PROGRAMMING GENERATOR PRODUCING POWERFUL NANOSECOND PULSES

V.P. Krivlov, A.N. Meshkov, V.N. Smirnov and V.I. Shishko
Gorkii Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 18, No. 6, pp 1788-1789
(12/1975).
Trans. From: Pribyti i Tekhnika Eksperimenta 6, 106-107
(November-December 1975).

A controlled paired-pulse generator is described which uses the shaping of electromagnetic shock waves in a transmission line containing ferrite. The external program stipulates the time interval between the pulse edges (10, 50, or 250 nsec) which determines the duration of the electron beam in a high-current linear electron accelerator to which the generator pulses having an amplitude of 4 kV are supplied. The generator ensures a rise and decay time of the electron concentration in the beam amounting to 2 nsec, and a time instability of the beam relative to the starting pulse which does not exceed 1 nsec. 2 Refs.

Primary Keywords: Pulse Generator; Paired-pulse Generator; Ferrite Loaded Line; Electromagnetic Shock Wave; 2 ns Rise And Fall; 40-ohm Impedance

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

6493

(SWITCHES, OPENING)

(Hall Effect)

APPLICATION OF THE HALL EFFECT TO THE SWITCHING OF INDUCTIVE CIRCUITS

E.K. Hall, A.E. Robson and P.J. Turchi
Naval Research Lab, Washington, DC 20375
The Review Of Scientific Instruments, Vol. 48, No. 4, pp 462-463
(04/1977).

Experiments are described in which the application of a pulsed magnetic field to a Corbin disk of indium antimonide causes an increase in resistance of about 2 orders of magnitude in a time of 5 microseconds. The use of this element as a switch for the transfer of energy from an inductive energy store is discussed. 9 Refs.

Primary Keywords: Hall Effect Switch; Pulsed Magnetic Field; Indium Antimonide; Corbin Disk; 100-fold Increase In Resistance; 5 Microsecond Rise Time

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6494
(BREAKDOWN STUDIES; PARTICLE BEAMS, ELECTRON)
(Vacuum, Electrical; Generation)

ARRANGEMENT FOR STUDYING FIELD EMISSION IN THE NANOSECOND AND SUBNANOSECOND RANGES
B.A. Koval, D.I. Proskurovskii and V.P. Rotstein
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 22, No. 4, pp 1146-1151
(08/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 6, 243-247 (July-August 1979).

An experimental arrangement is described for studying field emission in the pre-explosion mode with a pulse duration of up to 0.7 nsec. The Fowler-Nordheim characteristics are given along with oscillograms of the transition of field emission to the explosion emission mode. 5 Refs.

Primary Keywords: Field Emission; High Current Density; Emitter Melting; Vacuum Breakdown; Peak Current vs Pulse Width

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

6496
(BREAKDOWN STUDIES)
(Gas, Electrical)

BREAKDOWN MECHANISM OF A NARROW AIR GAP. II
S.I. Andreev and B.M. Sokolov
Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 254-256 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 349-352 (February 1966).

The current, impedance, and dissipated energy are measured for diffusor glow formation when the discharge gap is broken down by nanosecond pulses. The conditions for formation of a cathode spot and of a spark channel in a discharge in air at $p=45$ Torr cm are investigated. 8 Refs.

Primary Keywords: Air Breakdown; Current Measurement; Energy Dissipated; Glow Discharge; Nanosecond Pulse; Cathode Spot; Spark Channel

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6503
(PARTICLE BEAMS, ELECTRON)
(Generation)

ELECTRON ACCELERATION IN A TWO-CONDUCTOR STRUCTURE
E.G. Bessonov and A.V. Serov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Technical Physics Letters, Vol. 4, No. 4, pp 188-189 (04/1978).
Trans. From: Pis'ma Zhurn. Tekhnicheskoi Fiziki 4, 467-470 (April 26, 1978).

Picosecond beams can be produced by shock acceleration-a method in which the particles are accelerated in reflection from a moving potential barrier. There are several ways to produce a moving potential barrier. Fermi drew attention to one possible shock acceleration mechanism in space. Vekler suggested a collective shock acceleration method. This method is now usually associated with the acceleration of positive ions in the potential well of an electron ring which is accelerated as it collides with a 'heavier' electron ring that moves with a relativistic velocity. With the shock acceleration method, a heavy electron ring can also be used to accelerate a beam of negative ions. It is already possible to produce an electron ring which is capable of reflecting electrons and negative ions which are at rest with an energy increment approximately 100 MeV/m. A proposed accelerating structure reflects particles from a moving electromagnetic wave with a longitudinal electric field component. In the present letter we report on experimental study of electron acceleration in a structure of this kind. 9 Refs.

Primary Keywords: Picosecond E-beam Generation; Shock Acceleration; Electron Ring

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6506
(BREAKDOWN STUDIES; PARTICLE BEAMS, ION)
(Vacuum, Electrical; Generation)

EMISSION PROPERTIES OF THE PLASMA OF VACUUM SPARKS. I. ION BEAMS
K.V. Sulazde and A.A. Plyutto
Soviet Physics-Technical Physics, Vol. 10, No. 7, pp 1006-1015
(01/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1298-1307 (July 1965)

The emission properties of the plasma of vacuum sparks in producing heavy-current beams of H^{+} and D^{+} with a spark source were studied. With large emitting surface (5 to 7 sq.cm.) ion currents of 5 to 15 A/sq.cm. and total ion currents of 50 to 100 A in a 16-sec pulse were achieved. The ion current to the Faraday cylinder was 62% of the total current. Compensation of the beam by secondary electrons has been observed. Mass-spectroscopic investigations show that the H^{+} and D^{+} ion amount to 80% of the total beam current on the average. 29 Refs.

Primary Keywords: Ion Beam Generation; Vacuum Breakdown; 100 A Ion Beam; Hydrogen Ion Beam; Deuterium Ion Beam

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6509
(ENERGY STORAGE, CHEMICAL; PULSE GENERATORS)
(Flux Compression Generators; Flux Compression)

EXPERIMENTS WITH AN EXPLOSIVE-MAGNETIC GENERATOR IN LABORATORY CONDITIONS
E.I. Bichenkov, E.E. Voltenko, A.F. Demchuk, A.A. Deribas, B.I. Kulikov, Yu.E. Nesterikhin and O.P. Slobolev
Soviet Physics-Doklady, Vol. 13, No. 12, pp 1256-1257 (06/1969).
Trans. From: Doklady Akademii Nauk SSSR 183, 1289-1291
(November-December 1968)

Explosive-magnetic generators are a very promising means of conducting experimental work, particularly in the field of high temperature plasmas and short duration iron-free accelerators with high current densities. The main advantage of using explosives in powerful current sources, as compared, for example, with banks of capacitors, are found in the large output of electrical power and the great energy. The investigations of large explosive-magnetic generators have been conducted on outdoor proving grounds, because of the shock wave and the explosion product fragments produced during the test. The distinctive feature of the present paper is the conduct of experiments with explosive-magnetic generators under laboratory conditions, which enlarges the possibilities of their use. 5 Refs.

Primary Keywords: Flux Compression Generator; Laboratory Testing; 14 MA Current; Plane Configuration

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6510
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Thyatron)

FAST HIGH-VOLTAGE HIGH-CURRENT SWITCH: THYRATRON-SPARK GAP HYBRID
R.B. Gibson
Massachusetts Institute of Technology, Cambridge, MA
The Royal Society of Scientific Instruments, Vol. 50, No. 11, pp 1489-1490
(11/1975).

A high-voltage high-current switch using a hydrogen thyatron in series with a two-element spark gap is described. The hybrid switch triggers like a thyatron, turns off like a spark gap, and holds off twice the potential of either element alone. 0 Refs.

Primary Keywords: Thyatron; Self-trigger Spark Gap; Series Combination; Thyatron Triggering; Spark Gap Recovery

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6518
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM BY FIELD EMISSION
I.H. Silvert
Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 249-253 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 342-348 (February 1966).

Approximate values of currents are determined by analyzing the conditions at the electrodes and within the interelectrode gap leading to vacuum breakdown because of partial melting at the anode and at the cathode and because of space charge resulting from ionization of the anode material vapors. The relative effectiveness of the above processes as initiators of breakdown between flat electrodes at various voltages and for various cathode microstructures are then compared. 14 Refs.

Primary Keywords: Field Emission; Prebreakdown Current; Anode Melting; Cathode Melting; Cathode Microstructure; Theory

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6528
NANOSECOND PULSERS FOR MM WAVE TUBES

J. Stover, N. Komatsu and A. Niota
ECOM, Fort Monmouth, NJ 07703
Interne rept. no. 2, Feb-May 79 No. HAC-FR-79-14-353, 18p (02/1980).

Availability: AD-A080 990/5

NTIS
The AVG avalanche transistor has been selected as the switching element for the nanosecond pulsers, still open for consideration is a high voltage (4000 V) MMOS FET that will be available shortly for evaluation of that device comparing it in reliability.

Primary Keywords: Pulse Generators; Electronic Switches; Metal Oxide Semiconductors; Field Effect Transistors; Switching Circuits; Bipolar Transistors; Millimeter Waves; Junction Transistors; Power Supplies; Avalanche Effect(Electronics); Electro. Tubes; Electric Wire

Secondary Keywords: Avalanche Transistors; NTISDODXA; NTISDODA

6532
(PARTICLE BEAMS, ELECTRON)
(Generation)

PULSED DESORPTION SLOT CATHODE
E.N. Danil'tsev and V.I. Pershin
Instruments And Experimental Techniques, Vol. 22, No. 6, pp 918-922 (08/1979).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 36-39 (July-August 1979).

This paper describes a pulsed desorption slot cathode consisting of an assembly projecting above a metal surface and comprising dielectric walls, the sides of which are directed along the applied electric field while the ends lie parallel with the plane of the anode. A cathode with an area of approximately 1 sq.cm. subjected to a pulse voltage of 65 kV with duration 35 nsec can provide a current of 370 A. The authors estimate the emission capacity of such a cathode. The stability of operation of the cathode is shown by experiment to be high at a current density of 370 A/sq.cm. 8 Refs.

Primary Keywords: Pulsed Desorption Slot Cathode; E-beam Generation; E-field Structure; Metal Substrate; Adsorbed Gas

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

6535
(PARTICLE BEAMS, ELECTRON)

(Generation)

SELF-ACCELERATION OF A CHOPPED ELECTRON BEAM IN A FERRITE-FILLED WAVEGUIDE
H.N. Nasanov and A.M. Shenderovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR

Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1090-1093 (09/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1873-1878 (September 1976).

The shock excitation of the precession of the magnetic moment of a ferrite by the trailing edge of an intense electron beam that moves along the axis of a waveguide filled with ferrite rings, magnetized to saturation, is analyzed. Solution of Maxwell's equations and the Landau-Lifshitz equation for the remagnetization of the ferrite yields an electric field which accelerates the particles at the trailing edge of the beam. Axially magnetized and azimuthally magnetized ferrites are considered. 3 Refs.

Primary Keywords: E-beam Generation; Self-acceleration; Ferrite Ring; Saturated Magnetization; Remagnetization; E-field Generation

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6542

(SWITCHES, OPENING)

(Gas Gaps; Crossed-field)

THE GAMITRON-A HIGH POWER CROSSED-FIELD SWITCH TUBE FOR HVDC INTERRUPTION

M.A. Lutz and G.A. Hofmann
Hughes Research Labs, Malibu, CA 90265

IEEE Transactions On Plasma Science, Vol. PS-2, No. 1, pp 11-18 (03/1974).

A high power crossed-field discharge device has been developed for use as a high voltage direct current interrupter. This device operates at low pressure (10^{-6} Torr), conducting current at a fixed voltage (approximately 500 V) only in the presence of a weak magnetic field (approximately 100 G) which is substantially perpendicular to the electric field between the electrodes. When the magnetic field is removed, ionization ceases and current interruption results. Physical phenomena occurring in this device have been investigated, including the glow-to-arc transition, gas cleanup, and high voltage breakdown. Based on the results of these investigations, switch tubes have been developed and successfully tested at the 2 kA, 100 kV level, with recovery rates in excess of 2 kV/microseconds. The availability of such devices will make possible many applications including HVDC circuit breakers, AC current limiters, and practical inductive energy storage. 30 Refs.

Primary Keywords: Crossed-field Switch; Gamitron; Opening Switch; External Magnetic Field; Field Removal; Opening; Glow-to-arc Transition; Gas Cleanup; 2 kV/microsecond Opening Rate

COPYRIGHT: 1974 IEEE, REPRINTED WITH PERMISSION

6543

(PARTICLE BEAMS, ELECTRON)

(Generation)

THE GROWTH RATE OF THE POWER IN A PULSED HIGH-CURRENT BEAM OF ACCELERATED ELECTRONS

I.N. Sivkov
All-Union Institute, Moscow, USSR

Instruments And Experimental Techniques, Vol. 18, No. 2, pp 352-354 (05/1975).

Trans. from: Pribory i Tekhnika Eksperimenta 2, 28-29 (March-April 1975).

It is shown that the growth rate of the power of a beam of electrons obtained in pulsed high-current accelerators is limited by the wave impedance of the circuit sections and primarily by the wave impedance of the diode. The indicated limitation may be overcome by means of a stepwise increase in voltage. A method for effecting such an increase is proposed. 4 Refs.

Primary Keywords: E-beam Generation; Power Rise; Circuit Impedance; Diode Impedance; Voltage Pulse Shaping

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6544

(POWER CONDITIONING)

(Saturation Reactors)

THE USE OF FERRITES FOR THE GENERATION OF POWERFUL HIGH-VOLTAGE PULSES OF NANOSECOND DURATION

S.I. Venyukov, M.P. Andreev and V.A. Serobryakov

State Optical Institute, USSR

Instruments And Experimental Techniques, No. 3, pp 502-505 (06/1962).

Trans. from: Pribory i Tekhnika Eksperimenta 3, 89-92 (May-June 1962). When a conductor located within the ferrite core is connected into the circuit of a high-current spark discharge, it is observed that high-voltage nanosecond impulses arise across the loaded section with powers of the order of 1E5 W. Data are presented concerning the influence of the discharge parameters on the amplitude, duration and repetition frequency of these impulses. 4 Refs.

Primary Keywords: Pulse Sharpening; Ferrite Loaded Transmission Line; Switch Parameters; Effect On Pulse Shape

COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

6545

(PARTICLE BEAMS, ELECTRON)

(Generation)

TRANSFORMER TYPE ACCELERATORS FOR INTENSE ELECTRON BEAMS

E.A. Abramyan

Institute Of Nuclear Physics, Academy of Sciences of the USSR,

Kovosibirsk, USSR

IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 447-455 (06/1971).

The principles and designs of transformer accelerators (TA) generating intense beams of charged particles over energy ranges 0.5-5 MeV are described. Pulse electron accelerators with pulse lengths of 1E-8 to 1E-5 sec are investigated (some of them have a repetition rate of several hundreds cps) as well as one-phase and three-phase 50-cps transformers. The most models' power efficiency is in the range of 60-95%, the averaged beam power comes up to or exceeds 10 kA and, in excess of 150 kW for one of the last models. The design of 5 MeV single-pulse TA with peak currents of 30 kA at pulse length of 40 nsec and of 1.2 MeV proton TA with average beam power of 10 kW are described. The features of main components of high voltage transformers and of intense current acceleration tubes are discussed. 18 Refs.

Primary Keywords: Transformer Accelerators; High Efficiency; 5 MeV Beam Energy; 30 KA Current; Design Considerations

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

6549

(POWER CONDITIONING)

(Pulse Transformers)

USING A CABLE PULSE TRANSFORMER IN THE POWER SYSTEM OF A GAS LASER

A.S. Nasibov, A.A. Isayev, V.M. Kaslin and G.G. Petrush

Physics Institute, Academy of Sciences of the USSR, Moscow, USSR

Instruments And Experimental Techniques, No. 4, pp 934-935 (08/1967).

Trans. from: Pribory i Tekhnika Eksperimenta 4, 232-233 (July-August 1967).

Pulsed gas lasers have recently gained wide use and are being intensively studied. Certain characteristics, for example, the possibility of generation in the widest spectral interval from ultraviolet to far infrared make them very promising for a number of practical problems. Up to the present time, generation in the ultraviolet region has been obtained only with gas lasers in the pulsed mode. The power attained with generators of this type reaches 200 kW. The discharge of a capacitor through a spark gap or a thyatron is usually used to excite pulsed gas lasers. Since the working voltages reach 50 kV, and in some cases higher voltage is desired, serious difficulties arise. The power supply for a pulsed gas laser that allows the required characteristics to be obtained by comparatively simple means is described below. 5 Refs.

Primary Keywords: Coaxial Cable Pulse Transformer; High Power; Low Pulse Distortion; High Efficiency

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

6552

(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE)

(Generation; Systems)

A MULTIELECTRODE ELECTRON-OPTIC SYSTEM WITH AN INDUCTIVE STORAGE DEVICE

FOR A HIGH-CURRENT ACCELERATOR

A.A. Kozlov, A.E. Maslov, G.I. Prakhova and I.N. Sivkov

Opticophysical Measurements, Moscow, USSR

Instruments And Experimental Techniques, Vol. 18, No. 3, pp 685-687 (06/1975).

Trans. From: Pribory i Tekhnika Eksperimenta 3, 25-27 (May-June 1975)

The circuit of an accelerator with an inductive energy-storage device and a multielectrode electron-optic system is described. The results of studying the characteristics of such a system with models are presented. The possibility of creating an electron-optic system having the properties required for an accelerator is demonstrated. 2 Refs.

Primary Keywords: E-beam Generation; Inductive Energy Store;

Electron-optic System; Design Considerations; Performance Test

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6562

(SWITCHES, CLOSING)

(Liquid Metal)

PULSE MODULATOR BEHAVIOR OF THE LIQUID METAL PLASMA VALVE (LMPV)

H. Wright Jr. (1) and J.R. Saylor (2)

(1) ECOM, Fort Monmouth, NJ 07703

(2) Hughes Research Labs, Malibu, CA 90265

1978 IEEE Thirteenth Modulator Symposium, pp 83-87 (06/1978).

The LMPV is a mercury-cathode, triggered, closing switch which employs a small area mercury pool and a cooled (-30 Deg.C.) condensing surface to maintain the conditions for vacuum arc operation. These conditions result in high-voltage capability, fast recovery and high current operation with negligible cathode wear. Therefore, the LMPV was considered to have potential as a high average power closing switch for modulator applications. An LMPV closing switch (LMPVCS) was built at Hughes Research Laboratories and evaluated at ERADCOM at voltages up to 150 kV, currents up to 6 kA and a 7.5 kA average current length up to 50 microseconds, and repetition rates up to 250 Hz. The device failed as a result of excessive anode dissipation caused by a long anode fall time on the order of 5 microsecond. Subsequent experimentation has indicated that the fall time is reduced at increased mercury vapor pressures, however, experiments are required to define the relation between the fall time and voltage hold-off capability. 3 Refs.

Primary Keywords: Closing Switch; Vacuum Gap; High Voltage; Fast Recovery; Rep-rated

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

6571

CONSTANT CURRENT CHARGING CIRCUITS FOR HIGH ENERGY MODULATORS

J.L. Carter

Department of the Army, Washington, DC

Patent No. PAT-APPL-759 680, 8p (06/1978).

Availability: AD-D005 499/951 NTIS

A means is described for achieving square wave charging of pulse forming networks in line type pulsers which include parallel pulse forming networks with charging inductors connected between the PFNs. The cumulative value of the distributed inductance of the charging inductors is chosen so that when combined with the total capacitance of the PFNs, the charging network pulselength equals the interpulse period. (Author)

Primary Keywords: Patents; Circuits; Pulse Modulation; Pulse Generators; Square Waves; Inductors; Capacitors; High Energy

Secondary Keywords: PAT-CL-328-65; NTISPA

Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, DC 20231 \$0.50.

6582

(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)

(Gas; Electrical; Miscellaneous)

SPECIOTROGRAPHIC ERRORS IN PULSED DISCHARGES

W.H. Wright Jr.

ECOM, Fort Monmouth, NJ 07703

The Review Of Scientific Instruments, Vol. 41, No. 2, pp 265-269 (02/1970).

The method of electronically processing the detector signal can be critical when making spectrographic measurements on a pulsed discharge. The output of a commonly used synchronous detector is dependent on both signal amplitude and signal pulse shape and, when the shape of the radiated light pulse varies with wavelength, serious errors can be introduced. Two disparate spectrograms are shown that were taken from the same light source, differing only in signal processing, and the reasons for the discrepancies are explained. When taking spectrograms of pulsed light sources where afterglow effects may result in a variable pulse shape, it is recommended that the synchronous detector not be used; if the resultant spectrogram is to be power vs wavelength, then some form of signal sampling should be used instead. A measurement technique using a sampling oscilloscope, signal processing as described, a curve is included that predicts the monitoring of error is needed when using the synchronous detector to process a rectangular pulse-exponential decay signal. The error discussed does not exist when studying a mechanically chopped continuous light source since the pulse shape then depends only on the chopper and is invariant. 6 Refs.

Primary Keywords: Pulsed Breakdown; Spectrographic Diagnostic; Synchronous Detector; Effect Of Wavelength

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

136

6583
(SWITCHES; CLOSING; SWITCHES; CLOSING; ENERGY STORAGE)
(Gas Gaps; Self; Gas Gap Systems; System Protection)

S. Schneider and A.J. Buffa
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-14, No. 8, pp 433-438
(08/1967).

A new design for a series spark-gap array for energy diverter usage has been developed. The electrical circuit of this array differs from previously reported energy diverter designs in two respects. First, the capacitors from each electrode to ground are eliminated; and second, the interelectrode capacitances of the gaps are not all equal. By varying the interelectrode capacitances of each gap in accordance with predetermined requirements, it was possible to study several triggering modes. In particular, two triggering modes were investigated: a "constant overvoltage" mode and an "increasing overvoltage" mode. 7 Refs.

Primary Keywords: Spark Gap Array; Series Operation; Non-constant Interelectrode Capacitance; Several Triggering Modes
COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION

6584
(DIAGNOSTICS AND INSTRUMENTATION)

(Current) RECTANGULAR BEAM FARADAY CUP

J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
1976 IEEE Pulsed Power Conference Proceedings, Paper IE-5 (11/1976).
A Faraday Cup was developed for calibrating current sensors in generators producing rectangular electron beams. The current is measured with 24 re-entrant variations of known area arranged to average the beam current. Design criteria are discussed, including the error due to spatial variations of the beam, the high frequency response, and late time effects due to resistive losses in the walls of the cavity. A criterion for optimizing the low frequency response of the cavity using the finite time constant of the passive integrator is given. 0 Refs.

Primary Keywords: Faraday Cup; E-beam; Current Sensor; Design Considerations
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6585
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)

INTERIM REPORT ON DEVELOPMENT OF HIGH POWER, SHORT DUTY TRANSFORMER/RECTIFIER UNITS

R.I. McNeill Jr. and R.L. Haumesser
Thermal Technology Lab, Inc., Buffalo, NY
1976 IEEE Pulsed Power Conference Proceedings, Paper IIE-2 (11/1976).
This report describes the development of transformer/rectifier (T/R) units capable of delivering high power for relatively short periods of time. The primary objective of the program was to develop lightweight and compact T/R-units to minimize the size and weight of the final system consistent with other specified requirements. A specific weight of 0.25-0.3 lbs./kva. was achieved for the final 6 MW T/R-system, including all associated external cooling apparatus. The results of parametric optimization and engineering design studies leading to the selection and final development of two (2) forced oil cooled 3 MW T/R-units are presented. Included in the results is a discussion of the advantages and disadvantages of different cooling techniques including vaporization, adiabatic, and forced liquid cooling and a detailed thermal analysis of the final T/R-system design. The development and use of computer aided transformer design optimization procedures is also discussed. 0 Refs.

Primary Keywords: Power Supply; Burnout Mode; High Power; Light Weight
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6587
(BREAKDOWN STUDIES)

(Liquid, Electrical)

BROADENING OF A HIGH-INTENSITY SPARK CHANNEL IN A LIQUID

V.S. Komel'kov and Yu.V. Skvortsov
Soviet Physics Doklady, Vol. 4, No. 6, pp 1313-1316 (06/1960).
Trans. From: Doklady Akademii Nauk SSSR 129, 1273-1276 (November-December 1959).

In the present paper, the results of an investigation on the initial stages of the broadening of a spark channel in a liquid (the first few cm of current flow) are described. A discharge originated in water along the axis of a cylindrical transparent container (chamber) with a diameter of 40-70 mm, a height of 50 mm, between brass needle-shaped electrodes placed at an interval of 12-15 mm. A current loop with a capacitance of 2.7-260 picrofarad and a potential $U_{\text{loop}}/I = 20-40$ kV, was discharged through a circuit with an inductance $L = 7 \times 10^{-6}$ henries. The loop was closed with the burning away of air or detonation-type dischargers, which received a synchronized pulse from a photorecorder. 5 Refs.

Primary Keywords: Water Breakdown; Initial Current; Voltage Measurement; Current Measurement; Photographic Measurement; 12 kA Current; Thermal Considerations
COPYRIGHT: 1960 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6590
(INSULATION, MATERIAL)

(Liquid)

DIELLECTRIC STRENGTH OF PAPER-OIL INSULATION ACTED ON BY DC VOLTAGE
V.G. Butkevich, A.K. Lekhanin and V.M. Ponomarenko
Soviet Electrical Engineering, Vol. 49, No. 4, pp 47-52 (04/1978).
Trans. From: Elektrotehnika 49, 28-32 (1978).

The authors study the resistivity and dielectric strength of oil-immersed paper sheet and tape insulation in this paper. Field strength, temperature, and moisture content were all varied in a controlled experiment to determine their effect on the properties of the insulation in series. 8 Refs.

Primary Keywords: Oil-immersed Paper Insulation; Resistivity Measurement; Dielectric Strength Measurement; DC Field; Field Strength Variation; Moisture Variation
COPYRIGHT: 1978 ALLERTON PRESS, INC.

6595
(PARTICLE BEAMS)

(Generation)

FORMATION OF INTENSE CHARGED PARTICLE BEAMS IN A CURRENT-CARRYING PLASMA

K.V. Sulidze
Sukhumi Physotechnical Institute, Sukhumi, USSR

JETP Letters, Vol. 15, No. 11, pp 459-462 (06/1972).

Trans. From: ZhETF Pis'ma V Radaktiyu 15, 648-652 (June 1972)

This paper reports an investigation of intense charged-particle beams occurring in a current-carrying plasma as a result of formation of a "break" on which the entire potential difference is concentrated. A strong electric field inside a plasma accelerates the charged particles and the entire discharge current is carried by the beams of electrons and ions. The limiting accelerated-particle current J_{Env} is determined by the plasma concentration and can reach large values. 10 Refs.

Primary Keywords: Particle Beam Generation; Plasma Dynamics; Potential Braking; Turbulent Plasma Layer; E-beam; Ion Beam
COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6598
(PARTICLE BEAMS, ELECTRON)

(Generation)

HIGH-CURRENT PULSED ELECTRON ACCELERATOR

E.A. Abramyan and S.B. Vasserman
Soviet Atomic Energy, Vol. 23, No. 1, pp 709-711 (07/1967).

Trans. From: Atomnaya Energiya 23, 44-45 (July 1967)

The acceleration of electron beams with intensities of hundreds of amperes of energies of several MeV with pulses lasting $10^{-5} - 10^{-6}$ sec can be carried out very effectively with apparatuses in which a Tesla transformer is used as a high-voltage source. 0 Refs.

Primary Keywords: Electron Accelerator; 10⁻⁵ - 10⁻⁶ Sec Pulse Length; Tesla Transformer; High Pulse Powers; High Average Beam Powers; High Efficiencies; Several Hundred Amp Beam Current
COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

6599
(PULSE GENERATORS; POWER CONDITIONING)

(Systems; Saturable Reactors)

HIGH-VOLTAGE GENERATORS OF NANOSECOND PULSES

M.Yu. Gel'stai, A.D. Panfilov, V.S. Panasyuk, S.S. Sobolev and L.I. Yudin
Institute Of Nuclear Physics, Academy Of Sciences Of The USSR,

Novosibirsk, USSR

Instruments And Experimental Techniques, No. 3, pp 613-618 (06/1966).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 101-107 (May-June 1966)

Pulse generators are described providing voltage pulses of a duration from 5 to 30 nsec, 1 to 5 nsec rise times, and amplitudes up to 50 kV. The stability of delay between the trigger and output pulse is of the order of 1 nsec. Hydrogen thyratrons are used as switching elements. The leading edge of the pulse is shaped by a nonlinear ferrite line, and its termination by a short-circuited cable section. 7 Refs.

Primary Keywords: Pulse Generators; 5-30 nsec Voltage Pulse Duration; Hydrogen Thyratron; 50 kV Amplitude; Nonlinear Ferrite Line; Pulse Shaping Circuit; 1-5 nsec Rise Times
COPYRIGHT: 1966 PLENUM PRESS, REPRINTED WITH PERMISSION

6603
(POWER CONDITIONING)

(Pulse Transformers)

NEW PULSED X-RAY MACHINES, TYPE IRA-1 AND TYPE IRA-1D

N.I. Komysok and E.A. Pel'ks
Special Constructor Dept. Of X-ray Apparatus
The Soviet Journal Of Non-destructive Testing, No. 5, pp 420-424 (10/1967).

Trans. From: Defektoskopiya 5, 91-96 (September-October 1967).
Pulsed x-ray machines having a transformer source for high voltage are described. It is demonstrated that the weight and size of x-ray machines are significantly reduced when a pulse transformer is used instead of a condenser bank to obtain the high voltage pulses. This permits the apparatus to be used both for studies of rapidly proceeding processes and for defectoscopy under field conditions. 6 Refs.

Primary Keywords: Pulse Transformer; Pulse Generators; Weight And Size Reduced; Rapidly Proceeding Process Studies; Defectoscopy; Pulse Radiography; Short, High Intensity Pulses
COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

6605
(ELECTROMAGNETIC FIELD GENERATION)

(Pulses)

PULSED MAGNETIC FIELD OF MASSIVE SOLENOID WITH MOVING CONDUCTING SHELL

V.M. Mikhalev and E.I. Pis'mennyi
Power Engineering, Vol. 16, No. 5, pp 63-68 (10/1978).

Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 16, 73-78 (1978)

The authors study the expansion or compression of a conducting shell in a solenoid with a conducting core or die. The field distribution is calculated using a 1-dimensional formulation. 12 Refs.

Primary Keywords: Pulsed Magnetic Field; Massive Solenoid; Conducting Shell; Die; Shell Displacement; Invariant Field Strength; Integrordifferential Equations; Theory
COPYRIGHT: 1978 ALLERTON PRESS

6607
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)

(Magnetic, Flux Compression)

SOME CHARACTERISTIC FEATURES OF DIFFUSION OF A MAGNETIC FIELD INTO A MOVING CONDUCTOR

F.I. Bichenkov
Journal Of Applied Mechanics And Technical Physics, Vol. 8, No. 1, pp 90-91 (02/1967).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 8, 132-133 (1967)

The study of the diffusion of a magnetic field into a moving conductor is of interest in connection with the production of high-strength magnetic fields by rapid compression of conducting shells. It is shown that when a magnetic field in a plane slit is compressed at constant velocity, the entire flux enters the conductor. In the present paper we formulate a general result concerning the conservation of the sum current in the cavity and conductor for arbitrary motion of the latter. We also consider a special case of conductor motion when the flux in the cavity remains constant despite the finite conductivity of the material bounding the magnetic field. 6 Refs.

Primary Keywords: Magnetic Field; Diffusion Into A Conductor; Flux Compression; Constant Velocity Conductor Movement
COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

**6608
(PARTICLE BEAMS, ELECTRON)
(Generation)**

SPARK SOURCE IN A HIGH-CURRENT ELECTRON INJECTOR
K.V. Suladze, A.A. Plyutto and D.V. Iremashvili
Institute Of Physics And Technology, Academy Of Sciences, Georg. SSR,
Sikhumi, USSR
Instruments And Experimental Techniques, No. 3, pp 509-510 (06/1965).
Trans. From: *Pribory i Tekhnika Eksperimenta 3*, 46-47 (May-June 1965)
The present article provides some of the results obtained in testing a spark source in an electron injector capable of producing a focused pulsed electron beam with a current of 10 A for trapping voltage pulses with a duration of 5×10^{-8} sec and an amplitude of up to 10^6 V. 5 Refs.

Primary Keywords: Spark Source; High-current Electron Injector;
Focused Electron Beam; 10^6 V Amplitude; 10 A Current
Field Emission Diode.

COPYRIGHT: 1965 PLENUM PRESS, REPRINTED WITH PERMISSION

**6609
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)**

SPECIAL MEANS FOR MEASUREMENT OF THE ELECTRICAL PARAMETERS OF ELECTROPHYSICAL INSTALLATIONS
M.P. Vasilev, V.P. Gerasimov, O.A. Gusev, V.P. Zhurav, V.G. Kunstman,
I.V. Mozin, S.S. Rakhimov and V.A. Skobrev
Power Engineering, Vol. 16, No. 3, pp 57-60 (01/1978).
Trans. From: *Izvestiya Akademii Nauk SSSR. Energetika i Transport* 16,
65-69 (1978).

Pulsed current and voltage measurements are vital to any installation that utilizes pulsed power. The authors describe design principles for equipment to measure voltages in the range of 50 kV 5 MHz and currents of over 1 MA. Data transmission in a pulsed power environment is also considered. 0 Refs.

Primary Keywords: Electrical Diagnostics; Electrophysical
Installations; Pulse Signals; High Accuracy; Ultra
High Voltage Reduction; Measurement Converters;
Direct-current Transformers; Data Transmission

COPYRIGHT: 1978 ALLERTON PRESS, INC.

**6610
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)**

STUDY OF OPERATION OF CONTROLLED SPARK GAPS IN AIR

P.I. Shkurope
Soviet Physics-Techical Physics, Vol. 5, No. 8, pp 895-902 (02/1961).
Trans. From: *Pribory i Tekhnika Fiziki* 30, 456-463 (August 1960)

A study was made of the relation between the breakdown time lag of controlled spark gaps in air at atmospheric pressure and various trigger conditions. On the basis of the experimental data obtained a mechanism for the development of the discharge in triggered spark gaps is proposed. A recommended design for a controlled spark gap with a short time lag is given. 6 Refs.

Primary Keywords: Spark Gap Breakdown; Trigger Variation; Breakdown
Time; Breakdown Mechanism; Sphere-sphere Gap;
Aluminum Electrodes; Steel Insert

COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

**6612
(PULSE GENERATORS; POWER CONDITIONING)
(Systems; Pulse Transformers)**

TRANSFORMERS FOR HEAVY-CURRENT NANOSECOND IMPULSES

B.M. Koval'chuk, V.V. Kramnev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, No. 3, pp 672-676 (06/1969).
Trans. From: *Pribory i Tekhnika Eksperimenta 3*, 125-129 (May-June 1969)

A procedure has been developed for calculating transformers for nanosecond current impulses based on segments of long lines using ferrites as decoupling elements. Results of an experimental check of the proposed method are given. Transformer constructions are described which can deliver current impulses of up to 10^3 A of 10^{-7} to 10^{-8} sec duration, with a front length of 10^{-9} sec on a load of 0.2 to 2 ohm. 6 Refs.

Primary Keywords: Nanosecond Current Impulses; Pulse Transformers; 10^3 A
Current Impulses; 10^{-9} sec Pulse Front; Low Output
Impedance

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

**6613
(POWER TRANSMISSION)
(Transient Effects)**

TRANSIENT ELECTROMAGNETIC PROCESSES IN DEVICES WITH HEAVY CURRENT LEADS
V.M. Mikhalev
Power Engineering, Vol. 16, No. 4, pp 41-48 (08/1978).
Trans. From: *Izvestiya Akademii Nauk SSSR. Energetika i Transport* 16,
48-55 (1978).

The authors present an analysis of transients in the environment surrounding cables carrying high current pulses. The fields surrounding the cables are calculated numerically for a rectangular cross-section bus and the crosstalk to another rectangular bus is also calculated. 13 Refs.

Primary Keywords: Field Calculations; Numerical Formulations; Plane
Pulse Electromagnetic Field; Heavy Current Leads;
Transient Regimes; High Current Energy Transport

COPYRIGHT: 1978 ALLERTON PRESS, INC.

**6617
(POWER CONDITIONING)
(Saturable Reactors)**

A CIRCUIT USING FERRITES TO OBTAIN HIGH-VOLTAGE NANOSECOND PULSES
R.B. Bakht and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR

Instruments And Experimental Techniques, No. 3, pp 598-600 (06/1964).
Trans. From: *Pribory i Tekhnika Eksperimenta 3*, 108-110 (May-June 1964)

The authors describe a circuit for generating short pulses with amplitudes of up to 25 kV by means of a nonlinear element with ferrite toruses and a cable propagating a voltage pulse. They give data about the influence of parameters of propagating pulses on the shape and amplitude of the output signal. 3 Refs.

Primary Keywords: Pulse Sharpening; Nanosecond Pulses; 20 kV
Amplitudes; Ferrite Toruses

COPYRIGHT: 1964 PLENUM PRESS, REPRINTED WITH PERMISSION

**6618
(PULSE GENERATORS)
(Pulse Forming Lines)**

A SUPPLY GENERATOR FOR A STREAMER CHAMBER WITH A LARGE INTERELECTRODE GAP
G.A. Vorob'ev, N.S. Rudenko, V.I. Tsvetkov and M.I. Kozlov
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 1, pp 65-68 (02/1967).
Trans. From: *Pribory i Tekhnika Eksperimenta 1*, 68-71
(January-February 1967)

Spark chambers that operate in the streamer (track) mode permit the ionization of the recording of particle tracks to be increased considerably. The development of electron avalanche and streamers in neon is defined in times of 10^{-8} to 10^{-9} sec at field strengths of 7-15 kV/cm. When the chamber gap $d=10$ -20 cm, a pulse with an amplitude on the order of hundreds of kV, a controllable duration on the order of tens of nsec, and a duration stability of not worse than 10^{-9} sec is required. The proposed generator for chamber supply was developed on the basis of the generator proposed previously, which produced pulses with an amplitude of 500 kV and higher and a rise time of $1-2 \times 10^{-9}$ sec. In order to limit the pulse duration with acceptable accuracy, the main attention was given to the development of spark gaps and methods of connecting them. 3 Refs.

Primary Keywords: Pulse Generator; Streamer Chamber; 500 kV Amplitude
Pulses; $1-2 \times 10^{-9}$ sec Rise Time

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

**6619
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)**

A TRIGATRON FOR LARGE CURRENTS IN HIGH-VOLTAGE APPARATUS
S.A. Smirnov, L.A. Mrkhanenko and A.M. Shendrovich
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR,
Kharkov, USSR

Instruments And Experimental Techniques, No. 3, pp 503-506 (06/1961).
A trigatron is described which can handle currents up to 2.5 kA at voltages from 20 to 60 kV, for a pulse duration of 2.7 microseconds and a repetition frequency of 50-100 Hz. 7 Refs.

Primary Keywords: Trigatron Spark Gap; 2.5 kA Current Capacity; 60 kV
Operating Voltage; Repetition; Life Test

COPYRIGHT: 1961 PLENUM PRESS, REPRINTED WITH PERMISSION

**6620
(PULSE GENERATORS; PULSE GENERATORS)
(Merch; Pulse Forming Lines)**

A 500-KV NANOSECOND PULSE GENERATOR

G.A. Vorob'ev and N.S. Rudenko
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 1, pp 106-108 (01/1965).
Trans. From: *Pribory i Tekhnika Eksperimenta 1*, 109-111 (January 1965)

A 500-kV generator of pulses with a front of 1.5 nsec is described. The generator consists of a storage capacitor, in which glycerine is used as the dielectric, a pressurized discharge chamber, and a coaxial transmission line. The storage capacitor is charged from a single-stage pulse generator. Owing to the coaxial design of the discharge circuit could be reduced and a steep pulse front could be obtained. 8 Refs.

Primary Keywords: 500 kV Pulse Generator; 1.5 nsec Pulse Front;
Storage Capacitor; Pressurized Discharge Chamber;
Transmission Line

COPYRIGHT: 1961 PLENUM PRESS, REPRINTED WITH PERMISSION

**6621
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)**

(Magnetic Flux Compression)

AN APPROXIMATE THEORY OF MAGNETIC PILE-UP

H.N. Kalitkin and L.S. Tsernai
Magneto hydrodynamics, Vol. 5, No. 3, pp 5-9 (09/1969).

Trans. From: *Magnitnaya Gidrodinamika* 5, 8-14 (1969).

The compression of the magnetic field of a moving shell is considered when the shell exhibits finite conductivity and becomes heated in the process of compression. The envelope material is taken to be an incompressible fluid (which is justifiable for fields of up to 3-4 million Oe), and the magnetic field diffusion in the envelope is taken into account by the skin-layer method. With these assumptions the mathematical problem reduces to the solutions of a system of three ordinary differential equations, which may be solved exactly in a number of cases. The mechanical calculations which were carried out are in good agreement with experiment. 14 Refs.

Primary Keywords: Magnetic Field Compression; Magnetic Field
Diffusion; Magnetic Pile-up; Magnetohydrodynamic
Equations; Theory

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

**6622
(ENERGY STORAGE; CAPACITIVE; ELECTROMAGNETIC FIELD GENERATION)**

(Capacitor Banks; Magnetic)

APPARATUS FOR GENERATING INTENSE MAGNETIC FIELDS OF SHORT DURATION

E.I. Kondorkina and E.V. Sosov
Instruments And Experimental Techniques, No. 1, pp 118-123 (02/1963).
Trans. From: *Pribory i Tekhnika Eksperimenta 1*, 125-130
(January-February 1963)

An apparatus for producing intense short-duration magnetic fields of up to 0.9E 0e is described. The magnetic field pulse is produced by discharging a capacitor bank of nominal energy 13.5 kJ. Construction of solenoids and switches is described. 8 Refs.

Primary Keywords: Magnetic Field Generation; Intense, Short-duration
Fields; 13.5 kJ Nominal Energy Capacitor Bank; 3000
Microfarad Total Capacitance; Copper Wound Solenoids

COPYRIGHT: 1963 PLENUM PRESS, REPRINTED WITH PERMISSION

**6623
(BREAKDOWN STUDIES)**

(Exploding Wires)

CALCULATION OF THE VOLTAGE IMPULSE IN ELECTRIC EXPLOSION OF CONDUCTORS

V.L. Budovich and I.P. Kuchekin
Moscow Energetics Institute, Moscow, USSR

Electric Technology USSR, Vol. 95, No. 1, pp 24-32 (01/1975).

Trans. From: *Elektricheskoe 95*, 22-26 (1975).

The voltage pulse associated with the electrical explosion of a wire is studied theoretically in this paper. The voltage peak is calculated analytically using a serial arc model. Comparison with experiment shows good agreement. 16 Refs.

Primary Keywords: Slow Electric Explosion; Voltage Impulse Parameters;

Conductor Dimensions; Serial-arc Theory

COPYRIGHT: 1975 PERGAMON PRESS LTD.

6624
(POWER CONDITIONING)
(Saturable Reactors)

CONTROLLED DELAY OF HIGH-POWER NANOSECOND PULSES WITH THE USE OF THE MAGNETIZATION REVERSAL TIME OF FERRITES

R.B. Bakht, A.S. El'chaninov and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR

Instruments And Experimental Techniques, No. 4, pp 893-895 (08/1968).

Trans. From: *Pribyr i Tekhnika Eksperimenta* 4, 124-126 (July-August 1968)

A controlled delay system for high-power nanosecond pulses that is assembled from ferrite elements is described. The system ensures smooth variation of the delay in an interval of 0 to 50 nsec for a pulse of 5 to 15 kV amplitude and a leading edge of 3 nsec. The delay stability is not worse than for 1% of the maximum delay. 6 Refs.

Primary Keywords: Controlled Delay; System; High-power Nanosecond Pulses; Self-inductive Ferrite Element

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

6628
(BREAKDOWN STUDIES)
(Liquid, Electrical)

EXPANSION OF A SPARK CHANNEL IN A LIQUID

Yu.V. Skvortsov, V.M. Komeikov and N.M. Kuznetsov

Soviet Physics-Technical Physics, Vol. 5, No. 10, pp 1100-1112 (04/1961).

Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 30, 1165-1177 (October 1960) The investigation has been made of the initial stages of expansion of the channel in an intense spark in water for currents up to 7.5E5 amp. In the discharge circuit a rate-of-rise of 10E9 amp/sec. The rate of expansion of the channel boundaries, the velocity of the shock wave, the voltage in the spark channel, and the discharge time have been measured. Estimates are given of the conductivity and current density in the discharge channel. A hydrodynamic calculation of the pressure field and the velocity behind the shock-wave front is presented. 10 Refs.

Primary Keywords: Spark Channel Expansion; 7.5E5 Amp Currents; 2E11 Amp/sec Rate-of-rise; Hydrodynamic Pressure Field Calculation; Plasma Conductivity; Current Density

COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6632
(SWITCHES, CLOSING)
(Gas Gaps, Systems)

INDUCTANCE OF MULTICHANNEL HIGH-VOLTAGE DISCHARGERS

A.P. Komarov and I.N. Romashko

Soviet Electrical Engineering, Vol. 50, No. 7, pp 55-59 (07/1979).

Trans. From: *Elektrotechnika* 50, 27-29 (1979). Low-inductance multichannel gas switching is the subject of this paper. Several types of multichannel operation are considered quantitatively. Several configurations from parallel operation of conventional spark gaps to creeping surface discharge switches are considered. 5 Refs.

Primary Keywords: Parallel Spark Gap Operation; Multichannel High-voltage Dischargers; Small Power Demand; 1-2 nH Minimum Inductance; Fast Rise Time; Low Erosion; Creeping Discharge Switch

COPYRIGHT: 1979 ALLERTON PRESS, INC.

6635
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)

INVESTIGATION OF RECTIFIER UNITS FOR PERIODIC CHARGING OF STORAGE CAPACITORS

A.E. Krasnopol'skii, L.F. Lebedev and V.B. Sokolov

Soviet Electrical Engineering, Vol. 50, No. 10, pp 58-63 (10/1979).

Trans. From: *Elektrotechnika* 50, 25-28 (1979). Capacitor charging circuits are described which use inductive and combination capacitive-inductive current limiting in the secondary circuit. Efficiencies as high as 85% are reported with almost total power factor compensation possible. A split-phase arrangement is used. 3 Refs.

Primary Keywords: Capacitor Charging Circuit; Split-phase Circuit; Inductive Limiting; Capacitive-inductive Limiting; High Efficiency; Experiment; Theory

COPYRIGHT: 1979 ALLERTON PRESS, INC.

6637
(BREAKDOWN STUDIES)
(Suspensions, Electrical)

MECHANISM OF SURGE BREAKDOWN IN SUSPENSIONS

A.A. Vorob'yev, M.P. Tonkonogov and F.D. Fominykh

Soviet Physics Journal, Vol. 11, No. 7, pp 69-70 (07/1968).

Trans. From: *Izvestiya Vysshikh Uchebnykh Zavedenii. Fizika* 11, 103-105 (1968).

Data are presented of the breakdown of suspensions of several solid materials in liquid dielectrics. Both dielectric and conducting particles are used in several dielectric liquids. Graphs are presented for several combinations of liquid and solid. 7 Refs.

Primary Keywords: Liquid Breakdown; Suspension Breakdown; Pulsed Dielectric Strength; Solid-phase Concentration

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

6638
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

METHOD OF MEASURING THE DISPERSION OF THE DELAY TIMES OF BREAKDOWN OF CONTROLLED SPARK GAPS

I.I. Aksenov, V.K. Bocharov, V.L. Golosnyak, A.L. Zhdanov, V.I. Slatin and S.A. Smirnov

Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR

Instruments And Experimental Techniques, No. 3, pp 755-756 (06/1968).

Trans. From: *Pribyr i Tekhnika Eksperimenta* 3, 232 (May-June 1968).

The most complete information on the stability of operation of spark gaps (distribution of the delay time, mathematical expectation of this quantity, variance, etc.) can be obtained by the method described in a previous paper. However, measurement by this method, based on statistical analysis of numerous oscillograms obtained by photographing each pulse on a separate frame, is a quite laborious process. The shortcoming of the method is especially felt when many measurements are required. These difficulties can be greatly lessened by using the below-described method based on automatic photographing of the oscillograms with subsequent processing of the photographs by a computer. The investigated signals are photographed from the screen of a pulse oscilloscope by an ordinary narrow-film camera, the reverse winding handle of which is connected to the film-drawing mechanism. As such a mechanism we can use the magnetic drive of a selector. The winding of the drive is supplied from the control unit, to the input of which are sent synchronizing pulses from the firing unit of the investigated spark gap. Each time after operation of the spark gap the drive moves the film 1.5-2 mm. When the film is completely rewound the protection device of the control unit de-energizes the supply circuit of the magnetic drive and switches on the triggering system. 3 Refs.

Primary Keywords: Controlled Spark Gaps; Delay Time Distribution; Oscillographs; Computer Data Processing; Jitter Measurement; Automatic Data Recording

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

6640
(PULSE GENERATORS)
(Pulse Forming Lines)

OBTAINING HIGH-VOLTAGE SQUARE PULSES

A.I. Pavlovskii and G.V. Sklizkov

Instruments And Experimental Techniques, No. 2, pp 320-322 (04/1962).

Trans. From: *Pribyr i Tekhnika Eksperimenta* 2, 98-100 (March-April 1962).

The paper describes a new method for obtaining square pulses whose amplitude exceeds the charging voltage applied to the transmission line which forms the pulses by a factor of several times. The circuit and construction are cited for an oscillator which produces a square pulse with an amplitude of 160 kV and a current of 600 amp when it operates into a matched load of 250 ohm, and a pulse amplitude of up to 300 kV when it operates into a load of 200 kohm. 0 Refs.

Primary Keywords: 160 kV Square Pulse Amplitude; 600 Amp Current; Long Coaxial Cables; 0.25 Microsecond Duration; 250 Ohm Impedance

COPYRIGHT: 1962 PLENUM PRESS, REPRINTED WITH PERMISSION

6641
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

ON THE USE OF GAS-DISCHARGE MICROGAPS IN HIGH-VOLTAGE NANOSECOND PULSE DEVICES

G.A. Mesyats, P.A. Vorob'yev and Yu.I. Bychkov

Radio Engineering And Electronic Physics, Vol. 10, No. 4, pp 668-670 (04/1965).

Trans. The authors discuss the use of spark gaps as switches and pulse sharpening devices in this paper. The variation of switching time with field intensity is found empirically for single gaps and a formula is given for cascaded gaps. Experimental tests are performed. 6 Refs.

Primary Keywords: Gas-discharge Microgaps; Spark Gas-discharge Switches; Strobotrons; Jitter Measurement; Empirical Delay Formula; Spark Gap System

COPYRIGHT: 1965 SCRIPTA PUBLISHING CO.

6644
(POWER CONDITIONING)
(Saturable Reactors)

SHORTENING THE FRONTS OF HIGH-VOLTAGE PULSES WITH THE AID OF A NONLINEAR INDUCTANCE

O.G. Il'in and A.M. Shenderovich

Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR

Instruments And Experimental Techniques, No. 1, pp 109-110 (02/1965).

Trans. From: *Pribyr i Tekhnika Eksperimenta* 1, 112-113 (January-February 1965).

A method of shortening pulse fronts with the aid of a nonlinear inductance (for example, a coil with a ferrite core) connected in series with a load is described. The parameters of the inductance are such that during a time equal to the duration of the front of a pulse from the shaper its value will be high. Therefore, the current rise during the time of the front will occur very slowly. Up until the end of the front, the core is saturated, the inductance is considerably reduced, and a fast current rise occurs. Oscillograms illustrating shortening of the front by the described method of from 30 to 7 nsec are given. 4 Refs.

Primary Keywords: Pulse Front Sharpening; Nonlinear Inductance; High Voltage Pulses; Core Saturation; Several Configurations

COPYRIGHT: 1965 PLENUM PRESS, REPRINTED WITH PERMISSION

6646
(PARTICLE BEAMS, ELECTRON)

SUPPLY AND CONTROL OF AN ACCELERATOR ACTING ON THE PRINCIPLE OF A TESLA TRANSFORMER

A.A. Egorov, V.S. Penasuk and V.M. Radchenko

Institute Of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR

Instruments And Experimental Techniques, No. 2, pp 261-265 (04/1968).

Trans. From: *Pribyr i Tekhnika Eksperimenta* 2, 18-23 (March-April 1968).

Described are charging units which were developed in conformity with the construction of Tesla transformer, used as an element of a direct action accelerator. The units can also be used in other cases. A circuit, operationally controlled by an electron beam current set below the accelerating potential, is described. 4 Refs.

Primary Keywords: E-beam Generation; Tesla Transformer; Direct Action Accelerator; Hydrogen Thyratrons; Supply Network; Grid Voltage

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

6648
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)
THE ELECTROMAGNETIC FIELD IN A CAVITY UNDERGOING COMPRESSION
I.M. Rutkevich
Moscow, USSR
Journal of Applied Mathematics And Mechanics, Vol. 31, No. 3, pp
574-585 (06/1967).
Trans. From: *Prikladnaya Mekhanika I Mekhanika 31*, 552-559 (1967)
A theory of magnetic flux compression is presented. The authors consider flux compression by a perfectly conducting boundary in plane and axisymmetrical geometries. The method of integral transformations is used to obtain an analytical solution to the compression problem.
9 Refs.
Primary Keywords: Magnetic Flux Compression; Extra-strong Magnetic Fields; Compressing Conducting Shells; 164 T Field Intensities; Homogeneous Magnetic Field; Integral Representations
COPYRIGHT: 1967 PERGAMON PRESS LTD.

6652
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)
A COMPENSATED SHUNT FOR MEASUREMENT OF POWERFUL NONSTATIONARY CURRENTS
A.P. Bakov, L.S. Gerasimov and A.M. Iskol'dskii
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1744-1745 (12/1973).
Trans. From: *Pribory i Tekhnika Eksperimenta 6*, 112-113 (November-December 1973)
The construction of a compensated shunt for measurement of megampere currents having a rise time of 10-8 sec is described. Oscillograms of the currents recorded by means of the proposed shunt are presented. 2 Refs.
Primary Keywords: Compensated Shunt; 10 MA Current Range; 10 ns Rise Time; RL Circuit
Secondary Keywords: Exploding Wires
COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

6654
(PARTICLE BEAMS, ION)
(Generation)
ACCELERATION OF IONS BY A RELATIVISTIC ELECTRON BEAM
A.A. Plyutto, K.V. Suladze, S.M. Temchin, G.P. Mkheidze, E.D. Korop, B.A. Tshkhadev and I.V. Golovin
Soviet Physics-Technical Physics, Vol. 18, No. 8, pp 1026-1028 (02/1973).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki 43*, 1627-1631 (August 1973)
The acceleration of ions by a relativistic electron beam is investigated. Protons are accelerated to 6-7 MeV by a beam of approximately 1 MeV electrons. The compositions of the beam and their energy distribution are studied. It is shown that the energies of protons accelerated by electrons increase more rapidly than linearly with increase in the accelerating voltage in the range 0.3-1 MeV. 11 Refs.
Primary Keywords: Collective Acceleration; 7 MeV Ion Beam Energy; Beam Diagnostics; Beam Profile Measurement
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6655
(PARTICLE BEAMS, ELECTRON)
(Generation)
ACCELERATION OF IONS IN AN ELECTRON BEAM
A.A. Plyutto, K.V. Suladze, S.M. Temchin and E.D. Korop
Soviet Atomic Energy, Vol. 27, pp 1197-1202 (11/1969).
Trans. From: *Atomnaya Energiya 27*, 418-423 (November 1969)
In the production of ion beams derived from vacuum spark plasma, particles have been observed with energy in excess of the accelerating potential. Further investigation has led to the observation of an effective process of acceleration of ions up to energies approximately 1-10 MeV, produced during formation of electron beams from a plasma. The present article gives an account of some results of investigating the process of acceleration of ions in electron beams during emission from the plasma produced by vacuum sparks. 9 Refs.
Primary Keywords: Collective Acceleration; Vacuum Spark Plasma; E-beam Generation; Ion Beam Generation
COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

6657
(PULSE GENERATORS)
(Flux Compression)
CALCULATING SCHEME AND SWITCHING-ON OF THE LOAD OF PLANE EXPLOSIVE-DRIVEN MAGNETIC GENERATORS
E.I. Bichenkov, A.E. Vol'tenko, V.A. Lebedev and E.P. Metochkin
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 14, No. 2, pp
176-180 (04/1973).
Trans. From: *Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 2*,
37-41 (March-April 1973)
A scheme is described for calculating explosive-driven magnetic generators, and analytical and numerical calculations are made of the problems of switching a generator onto a constant current load and induction load, to a load whose resistance rises linearly with the temperature, and to a plasma load with equilibrium radiation. In the latter case, a calculation is made of a current involving switching on the load through a matched transformer. 9 Refs.
Primary Keywords: Flux Compression Generator; Analysis; Numerical Calculation; Output Switch Analysis; Several Load Types
COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6660
(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Generation; Systems; Explosive Fuses)
DIRECT-ACTION ACCELERATORS WITH INDUCTIVE ENERGY STORAGE AND EXPLODING CONDUCTORS
Yu.D. Bakulin, V.S. Divenkov, V.P. Kovalev, A.I. Kormilitsyn, B.N. Lavrent'ev, A.V. Luchinskii and V.I. Martynov
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 323-326 (04/1979).
Trans. From: *Pribory i Tekhnika Eksperimenta 2*, 34-37 (March-April 1979)

Two generators of pulsed bremsstrahlung and electron beams are described, the IGUR-I and IGUR-II instruments, in which inductive storage devices with exploding conductors are used. At a voltage of 2.8 MV on the accelerator tube and a current of 44 kA through the tube the IGUR-I provides a bremsstrahlung dose of 110 R at a distance of 1 m from the anode, while the IGUR-II at a voltage of 3.7 MV on the tube and a current of 70 kA provides a dose of 700 R. On both instruments the half-width of the bremsstrahlung pulse is regulated in the range of 0.1-0.5 microsecond. Electron beams with an energy density of 300 J/sq.cm. are extracted from the accelerator tubes. 1 Refs.

Primary Keywords: E-beam Generation; Inductive Energy Storage; Opening Switch; 2.8 MV Operating Voltage
COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

6661
(BREAKDOWN STUDIES)
(Gas, RF)
DYNAMICS OF THE DEVELOPMENT OF HIGH-CURRENT INDUCTION DISCHARGE
P.N. Beronets, V.I. Myshenkov and M.I. Yakushin
Moscow, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 20, No. 3, pp
305-311 (06/1979).
Trans. From: *Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 3*,
58-67 (May-June 1979)

Pulsed high-current discharges in the range of relatively low pressures were investigated mostly in connection with the problem of controlled thermonuclear fusion. The need for investigating such discharges at elevated pressures was dictated to a considerable extent by the requirement for high-power light sources. Significant advances in investigating the structure and dynamics of the development of high-current discharges have now been achieved. However, there also remain unsolved problems. In particular, with regard to pulsed induction discharges, complete understanding of the mechanism of development of such discharges is still lacking. Our purpose is to investigate high-current induction discharges in argon at high gas pressures in the range from 5 to 100 mm Hg. The physical interpretation of individual stages in the development of high-current discharges is given on the basis of an analysis of the experimental data, and the stages of discharge development, the mechanism of which is not yet fully understood, are discussed. The discharge is investigated for relatively low energy inputs, when it is possible to separate in time the various stages of discharge development, which occur virtually simultaneously at high energy inputs. 8 Refs.

Primary Keywords: Induction Breakdown; 20 kHz Frequency; 70 V/cm Field Strength; Azimuthal E-field; Experiment; Theory
COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

6663
(ENERGY STORAGE, INDUCTIVE; ELECTROMAGNETIC LAUNCHERS)
(Systems; Plasma)
EFFECT OF INTERRUPTION TIME ON PLASMOID ACCELERATION IN AN INDUCTIVE ENERGY-STORAGE ACCELERATOR
N.V. Belan, N.A. Mashtylev and B.I. Pandzhevnyi
Soviet Physics-Technical Physics, Vol. 16, No. 3, pp 433-435 (09/1971).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki 41*, 559-562 (March 1971)
Plasmoid acceleration is discussed for an accelerator with inductive energy storage; it is assumed that a self-sustained arc is produced in the switching system. The plasmoid acceleration process is characterized by two stages: in the first the acceleration is due to power from the source; in the second the acceleration is due to the stored energy. A faster interruption time yields higher efficiency in acceleration in injectors of this kind. 5 Refs.
Primary Keywords: Plasmoid Acceleration; Inductive Energy Storage; Interruption Time; Charging Circuit; High Efficiency; Switching System; Self-sustained Arc
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6664
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRIC EXPLOSION OF SPIRAL WIRES IN VACUUM
I.F. Kvartskhava, V.V. Bondarenko, P.D. Meladze and K.V. Suladze
Soviet Physics-ETP, Vol. 35 (8), No. 4, pp 634-638 (04/1959).
Trans. From: *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 35*,
911-916 (October 1958)
When a bent wire is exploded in vacuum, the motion of the explosion products through the magnetic field of the current produces current tubes and also certain glow effects, due to the interaction of the streams of explosion products with each other. By scanning the explosion with a mirror, the stream fronts were found to have a speed of 166 cm/sec. A possibility of thermally insulating the plasma by means of the strong magnetic field that exists during a very short time of explosion is demonstrated. A qualitative explanation is proposed for the observed effect. 8 Refs.
Primary Keywords: Exploding Wire; Spiral Wire; Magnetic Field; Current Tubes; 166 cm/sec Stream Front Speed
COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6666
(BREAKDOWN STUDIES)
(Exploding Wires)

ELECTRICAL EXPLOSION OF WIRES IN VACUUM
I.F. Kvartskhava, V.V. Bondarenko, R.D. Miledze and K.V. Suladze
Soviet Physics JETP, Vol. 6, No. 5, pp. 637-644 (08/1957).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 737-744 (November 1956).

Results of an investigation of electric explosions of wires in vacuum are described. It is shown that regardless of the initial shape of the wire the explosion products propagate as in an ordinary explosion, in a direction normal to the surface of the wire. If the voltage across the capacitor of the explosion circuit is relatively low, the vapor streams, as in the case of an explosion in air, from layers that range themselves perpendicular to the wire. It has been established that at high capacitor voltages the motion of the vapor streams affects the distribution of the discharge current in the space around the wire. A qualitative explanation is given for the observed effects.

Primary Keywords: Vacuum; Discharge Current; Current Channel; Electrone Streamers; Exploding Wire; Geometry Independence

COPYRIGHT: 1957 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6668
(BREAKDOWN STUDIES; PARTICLE BEAMS; ELECTRON)
(Vacuum; Electrical; Generation)

ELECTRON EMISSION PROPERTIES OF A VACUUM SPARK. II. ELECTRON BEAMS
K.V. Suladze and A.A. Flyutte
Soviet Physics-Technical Physics, Vol. 12, No. 1, pp. 48-52 (07/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 72-73 (January 1967).

Details are given of the emission properties of the plasma of a vacuum spark that occurs in the production of a high-current electron beam. An emitting surface of 1 cm^2 provides electron densities of $100-250 \text{ A/cm}^2$ in a pulse of duration 1.5-2 sec. Certain features of the high-current beams have been studied by extraction of electrons from the plasma; this occurs in two stages. In the first stage the extracted current is independent of the voltage and is proportional to the plasma density. The anomalous resistance of the plasma is due to deceleration of the electrons by the waves excited at the onset of instability. The second stage shows a sudden increase in the current. 29 Refs.

Primary Keywords: Vacuum Breakdown; E-beam Generation; Plasma Emission; Anomalous Plasma Resistivity; Two Beam Generation Stages

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6671
(PARTICLE BEAMS; ELECTRON; SWITCHES; OPENING)
(Generation; Explosive Fuses)

EXPLODING FOILS FOR ACCELERATOR APPLICATIONS
A.B. Andrenko, V.A. Burtsev, V.M. Vodovozov and A.A. Drogzov
Soviet Technical Physics Letters, Vol. 5, No. 2, pp. 68-69 (02/1979).
Trans. From: Pis'ma Zhurn. Tekhnicheskoi Fiziki 5, 172-175 (February 1979).

The traditional design of high-current nanosecond electron accelerators uses shaping lines and Marx generators. Another approach makes use of exploding wires to generate the high-voltage pulses. This approach is attractive because it is simpler than the traditional approach and because inductive energy storage holds promise. 5 Refs.

Primary Keywords: E-beam Generation; High-voltage Pulses; Exploding Foil; Inductive Energy Storage; 10 kA Peak Beam Current; Capacitive Inductor Charging

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6672
(PULSE GENERATORS; ENERGY STORAGE; CHEMICAL)
(Flux Compression; Flux Compression Generators)
EXPLOSIVE GENERATORS

E.I. Bichenkov
Institute of Hydrodynamics, Academy of Sciences of the USSR, Moscow,
USSR
Soviet Physics-Doklady, Vol. 12, No. 6, pp. 567-569 (12/1967);
Trans. From: Doklady Akademii Nauk SSSR 174, 779-782 (June 1967).

In this paper, the results are discussed of experiments carried out in the Institute of Hydrodynamics, Siberian Branch of the Academy of Sciences of the USSR on the construction of explosive devices which convert explosive energy into magnetic field energy. Such devices have been called explosive generators. 6 Refs.

Primary Keywords: Flux Compression Generator; Explosive Driver; Design Considerations; Performance, etc.

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6673
(PULSE GENERATORS)
(Flux Compression)

FLUX DIFFUSION DURING MAGNETIC ACCUMULATION IN NARROW CAVITIES
E.I. Bichenkov and E.P. Metochkin
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 15, No. 4, pp. 555-559 (08/1974).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 148-152 (July-August 1974).

An equation is obtained for the flux diffusion during the compression of a uniform magnetic field in a flat gap. Calculations are performed for the case of the compression of the initial current and for a constant linear increase and an increase proportional to the square root of time in the initial current. It is shown that the flux losses are considerable even for large magnetic Reynolds numbers, the flux losses depend essentially on the pumping time and depend little on the shape of the pumping current pulse. 7 Refs.

Primary Keywords: Flux Compression; Flat Gap; Field Diffusion; Magnetic Reynolds Number; Current Pump; Pumping Speed

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

6674
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)

FLUX DIFFUSION UPON THE COMPRESSION OF A MAGNETIC FIELD BY FLAT STRIPS
OF VARIABLE WIDTH
E.I. Bichenkov and E.P. Metochkin
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 15, No. 4, pp. 865-868 (12/1974).

An equation is obtained describing the flux diffusion in flat profiled generators having magnetic cumulation (MC). The critical modes of operation of such generators of active and inductive loads are calculated. 4 Refs.

Primary Keywords: Magnetic Flux Compression; Flux Diffusion; Magnetic Cumulation; Powerful Pulsed Currents; Superstrong Magnetic Fields; Magnetic Flux; Flux Losses; Strip Conductance Constant; Load Resistance Constant

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

6675
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)

(Magnet of Flux Compression)

FLUX LOSSES DURING COMPRESSION OF A MAGNETIC FIELD BY FLAT STRIPS
E.I. Bichenkov and V.A. Lebedev
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 16, No. 2, pp. 216-219 (03/1975).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 2, 159-162 (March-April 1975).

The compression of a magnetic field by a moving conductor-magnetic cumulation is used to obtain powerful magnetic fields and large pulsed currents. The possibilities of magnetic cumulation are determined mainly by the flux losses due to diffusion of the magnetic field into the conductor surfaces. Experiments on the compression of a magnetic field by flat strips of copper and Dural are described in the report, and a comparison is made with the calculation of diffusional flux losses. The possible role of a gutter instability of the copper conductors is evaluated for the explanation of the increase in flux losses when a critical linear current density, whose value in the experiments presented was $180-210 \text{ kA/cm}$, is exceeded in the strips. 3 Refs.

Primary Keywords: Magnetic Field Compression; Magnetic Cumulation; Powerful Magnetic Fields; Large Pulsed Currents; Flux Losses; Flat Strips

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6676
(POWER CONDITIONING)

(Pulse Transformers)

HIGH-VOLTAGE MEGA-AMPERE CABLE TRANSFORMER
G.S. Villevailev, V.N. Krasavik and G.I. Sil'vestrov
Institute of Nuclear Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Instruments And Experimental Techniques, Vol. 20, No. 4, pp. 1105-1106 (08/1977).
Trans. From: Prilbyr i Tekhnika Eksperimenta 4, 166-168 (July-August 1977).

A cable transformer, without iron, with a voltage transformation factor of 10^4 or 10^5 in the primary 50 kV or tor 50 kV loop, respectively, and 25 kV in the load loop is described. The cable KK SF-17-12 is used in the transformer, and the number of parallel branches is 12. The scattering inductance, referred to the load loop is $L_{\text{load}}/S = 5 \text{ nH}$ for $n=2$ ($L_{\text{load}}/S = 6 \text{ nH}$ for $n=4$). Diagrams of working versions of generators using the transformer are presented. 3 Refs.

Primary Keywords: Cable Transformer; 25 kV Output Voltage; 50 kV Input Voltage; Low-inductance Load; Scattering Inductance; 2 MA Current; 100-200 kHz Discharge Frequency

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

6677
(ENERGY STORAGE; INDUCTIVE; PARTICLE BEAMS; ELECTRON)

(Reactors; Generators)

INCREASING ELECTRON BEAM POWER BY INDUCTIVE ACCUMULATOR
P.T. Bilynsk, G.I. Filigachev and D.N. Lin
Instruments And Experimental Techniques, Vol. 20, No. 2, pp. 368-370 (04/1977).
Trans. From: Prilbyr i Tekhnika Eksperimenta 2, 35-37 (March-April 1977).

A device consisting of a diode electron accelerator and an inductive accumulator in a beam collector circuit is described. When the anode-cathode gap is shorted by the plasma or as a result of breakdown across the insulator, a potential difference is generated in the collector-anode gap which can be used to accelerate the electrons emitted by the collector. It is shown experimentally that with a voltage of 240 kV between the anode and cathode, the collector-anode voltage is 600 kV. The power of the beam is then doubled. 6 Refs.

Primary Keywords: Field Emission Diode; Plasma Diode Closure; Inductive Energy Store Switch; Beam Collector; Explosive Electron Emission

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

6678
(PULSE GENERATORS)

(Flux Compression)

LIMITING CURRENTS IN THE COMPRESSION OF MAGNETIC FLUX BETWEEN FLAT AND COAXIAL CONDUCTORS
E.I. Bichenkov and V.A. Lebedev
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 16, No. 5, pp. 770-773 (10/1975).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 5, 116-120 (September-October 1975).

Experiments are described on magnetic flux compression by flat and coaxial conductors. The initial current I_0/S_0 is increased the final current I_f/S_f obtained as a result of flux compression at first increases proportionally to $1/S_0$ and then reaches a maximum and remains constant for further increases in $1/S_0$. Analysis of the experiments shows that in coaxial structures when a small explosive charge accelerates the conductors the limiting current is determined by the maximum work which a conductor can perform in compressing the magnetic field. In experiments with flat busbars and large explosive charges the limiting currents appear to be determined by the flux losses in short-circuited voids formed in the linking of irregular surfaces of the busbars. This assumption is shown to be in qualitatively agreement with experiment. 3 Refs.

Primary Keywords: Flux Compression Generator; Flat Conductors; Coaxial Conductors; Limiting Current; Maximum Field

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

- 6681**
(PULSE GENERATORS)
(Flux Compression)
MAGNETIC FIELD IN A CYLINDRICAL CONDUCTOR MOVING WITH A VELOCITY PROPORTIONAL TO R^{-1}
E.I. Bichennov and E.P. Matochkin
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 14, No. 5, pp 617-623 (10/1973).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 5, 18-23 (September-October 1973)
 Nonstationary magnetic field problems in a moving conductor are of interest in connection with obtaining pulsed magnetic fields by magnetic compression. The field penetrates into the conductor as a result of the growth of the skin layer and is reflected from the conductor. The first mechanism of the interaction of the magnetic field with a conductor is the self-similarity of the effects of the fluid, and the second - convection. Five self-similar solutions of magnetic field problems in a conductor which has a velocity via air and a conductivity σ are discussed and a numerical solution of the problem of the compression of a field in a cylindrical cavity when the conductor moves toward the axis is presented. One of the self-similar solutions is compared with the numerical solution. 8 Refs.

Primary Keywords: Flux Compression; Field-conductor Interaction; Field Diffusion; Field Convection; Theory; Analytical Solution; Numerical Calculation.

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6683
(PULSE GENERATORS)
(Flux Compression)
METHOD OF DESIGNING EXPLOSIVE-DRIVEN MAGNETIC FIELD GENERATORS
V. A. Lebedev
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 17, No. 1, pp 97-102 (02/1976).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 120-127 (January-February 1976).
 A method of designing explosive-driven magnetic field generators that allows us to establish a dependence between the parameters of the generator circuit, in which the greatest energy release occurs under a time-invariant resistive load, is described. The problem of switching two-dimensional generators to a load whose resistance linearly increases with temperature is analytically solved as an example. The theoretical possibility of designing a generator in which the power released under the resistive load $R(t)$ varies in a specified way with time is demonstrated. Types of current pulse, power, and energy released in the load are studied in the case of different generator circuit parameters. 8 Refs.

Primary Keywords: Flux Compression Generator; Resistive Load; Time-Invariant Load; Load Switching; Pulse Shaping; Circuit Parameter Variation.

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

6685
(ENERGY STORAGE, INDUCTIVE; POWER CONDITIONING)
(Systems; Nonlinear Resistors)
PRECISION PEAKING DISCHARGER WITH A NONLINEAR ELEMENT IN AN INDUCTIVE STOAGE CIRCUIT WITH FOIL BREAKER
A.V. Grigor'ev, A.G. Novikov, V.V. Tikhov and G.A. Shneerson
Instruments And Experimental Techniques, Vol. 23, No. 5, pp 1193-1194 (10/1980).
Trans. From: Priroby i Tekhnika Eksperimenta 5, 129-130 (September-October 1980).
 A solid-state peaking discharger for an inductive-capacitive energy store is described in which the switch element is based on Trivit-2, which is a material with a non-linear load-ampere characteristic. The discharger has repeatedly switched currents with an amplitude of 360 kA and a duration of 80 microseconds. The self-inductance $L_{\text{sub p}}$ of the discharger is 2.8 nH and its resistance $r_{\text{sub p}}$ is 2.8 m ohm. 4 Refs.

Primary Keywords: Nonlinear Resistor; Peaking Discharger; Inductive Energy Store; 2.5 nH Self-inductance, 260 kA Amplitude; Reproduced; 2 Microsecond Rise Time.

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

6687
(PARTICLE BEAMS, ION)
(Generation)
PULSED ION BEAMS FROM A HIGH-CURRENT PLASMA DIODE
B.A. Tskhadev, A.A. Plyutto and K.V. Sulezra
Soviet Physics-Technical Physics, Vol. 19, No. 8, pp 1108-1109 (02/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1779-1783 (August 1974)
 In a study of pulsed ion beams in a high-current plasma diode it has been found that an ion beam of 6E2 A is produced when a critical diode current is reached and a discontinuity appears in the plasma. The ion beam has a large energy spread, but the average energy is approximately equal to the initial voltage. $U_{\text{sub d}} = 0.3-50$ kV. The linear functional dependence of the diode current on the critical diode current implies that an beam with currents of 2E4 A can be achieved at diode currents of 1E4 A. 8 Refs.

Primary Keywords: Ion Beam Generation; Plasma-filled Diodes; 30-50 kV Diode Voltage; 30-50 kV Ion Beam Energy; Threshold Current.

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6688
(BREAKDOWN STUDIES)
(Exploding Wires)
RESTORATION OF THE DIELECTRIC STRENGTH FOLLOWING EXPLOSION OF A WIRE
R.K. Borisov, V.L. Budovskii and I.F. Kuznetsov
Moscow Engineering Institute, Moscow, USSR
Soviet Physics-Tech. Letters, Vol. 1, No. 12, pp 516-517 (12/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 3, 1250-1253 (December 1977).
 After an electrical explosion and the current cutoff, the insulating properties of the gap are known to be restored. An understanding of the process by which the dielectric strength is restored after an explosion can help in describing the state of the explosion products and the destruction mechanism of the wire. The rate at which the dielectric strength is restored is a characteristic which must be known in order to design switches, fast-acting fuses, etc. Although there are many papers on electrical explosions in the literature, no information is available on the restoration of dielectric strength after the explosion of a wire. Furthermore, there is no information on the restoration of the dielectric strength after the explosion of wires and cables. 6 Refs.

Primary Keywords: Explosions; Wires; Currents; Dielectric Strength; Environment; High Voltage; Insulation; Wire.

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6689
(PARTICLE BEAMS, ELECTRON)
(Generation)
SCREENING EFFECT IN HIGH-CURRENT DIODES
S.Ya. Belomyssov, S.D. Korotin and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics Letters, Vol. 6, No. 9, pp 466-467 (09/1980).
Trans. From: Pis'ma Zhurnala Tekhnicheskoi Fiziki 6, 1089-1092 (September 1980).
 Secondary processes which occur in high-current diodes with explosive electron emission lead to the appearance of new emission centers through propagation of the cathode plasma. We have found that there is an opposite effect, which opposes the spontaneous appearance of new centers of explosive electron emission. We have shown that a screening effect is responsible for this situation. The occurrence of explosive electron emission leads to a pronounced increase in the electric field near the cathode. The primary emission center, the current density of which explosive emission occurs, is proportional to $1/v_{\text{sub e}}$, where $v_{\text{sub e}}$ is the field-emission current, which is an exponential function of the electric field. Consequently, even a slight decrease in the electric field of the cathode prevents the spontaneous appearance of new emission centers. This effect leads to an insensitivity of the electron beam in an explosive-emission diode, and in several cases, e.g., that of the low-energy beams used for surface processing, it becomes difficult or even impossible to use these beams. 6 Refs.

Primary Keywords: Electron Generation; Field Emission Diode; Explosive Emission; Multiphoton Cathode; Screening Effect; Beam Insensitivity.

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6690
(BREAKDOWN STUDIES)
(Exploding Wires)
SELF-SIMILAR ELECTRICAL SKIN EXPLOSION OF A CONDUCTOR
E.I. Bichennov and A.E. Voronenko
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 10, No. 3, pp 350-355 (01/1969).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 10, 21-26 (May-June 1969).
 We examine the problem of the electrical explosion of a conductor with flat boundary in a strong magnetic field. We estimate the role of heat conduction in order to determine the critical electrical fields in which fusion and vaporization of the metal take place. The characteristic features of the explosion of a layered medium are examined. 6 Refs.

Primary Keywords: Flat Wire; Wire Skin Explosion; Magnetic Field; Thermal Conduction; Layered Wire.

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

6691
(BREAKDOWN STUDIES)
(Gas; E-beam)
SEMISELF-MAINTAINED DISCHARGE DEVICE WITH IONIZING BEAM REGENERATION
L.P. Formikina
Novosibirsk Branch Of State Nitrogen Industry Institute, USSR
Instruments And Experimental Techniques, Vol. 20, No. 1, pp 213-215 (02/1977).
Trans. From: Priroby i Tekhnika Eksperimenta 1, 186-188 (January-February 1977).
 A device for generating a semiself-maintained discharge in a gas, initiated by an electron beam from an accelerator, in which the electron beam is regenerated is described. With this device it is possible to achieve an electrical field strength in the base of >100 kV/cm without a transition into a spark discharge. 6 Refs.

Primary Keywords: Semiself-maintained Discharge; E-beam Sustained Discharge; Retarded E-beam; Very High Field Strength; No Spark Transition.

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

6692
(BREAKDOWN STUDIES)
(Liquid; Electrical)
THE DEVELOPMENT OF ELECTRICAL DISCHARGE IN WATER
A.P. Alkhimov, V.V. Vorob'ev, V.F. Klimkin, A.G. Ponamarenko and R.I. Solntsev
The Inst. of Nuclear Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-J. Russ. Phys., Vol. 15, No. 10, pp 959-961 (04/1971).
Trans. From: Izdatel'stvo Akademii Nauk SSSR, Nov. 194, 1052-1054 (October 1970).
 Distilled water is used in high-voltage impulse energy storage and switch-on devices and it is, therefore, necessary to make a thorough study of the physical features of the development of electrical discharge in water at field strengths of 100 to 500 kV/cm. In addition to clarifying certain fundamental problems of the physics of breakdown of water under these conditions it is of particular interest to obtain quantitative characteristics of the process, such as the delay time $t_{\text{sub d}}$, the streamer velocity $v_{\text{sub s}}$, and its dependence on the field strength $E_{\text{sub d}}$, the resistivity ρ , pressure p , etc. 2 Refs.

Primary Keywords: Water Breakdown; Distilled Water; Insulation; Delay; Streamer; Shadowgraphy; Voltage Measurement; Delay Measurement; Streamer Velocity; Measurement.

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6693
(ENERGY STORAGE, INDUCTIVE)
(Systems)
TRANSIENTS IN INDUCTIVE ENERGY-STORAGE DEVICES FOR PLASMA INJECTORS
N.Y. Boletin, N.A. Mashkov and B.I. Panachevnyi
Khurikov Aviation Institute, USSR
Soviet Physics-J. Technical Physics, Vol. 18, No. 1, pp 51-53 (07/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 83-86 (January 1973).
 The present work considers charging and discharging processes in an inductive energy-storage device for a pulsed plasma injector. A system of equations is given which describes the transient that arises in an inductive storage device when the charging circuit is switched by the moving plasma. The system is solved analytically for one particular case. An experiment involving transients in an inductive energy-storage device is described. The results of the experiments are in satisfactory agreement with the analytic solution of the system of equations. 6 Refs.

Primary Keywords: Charging Process; Discharge Process; Plasma Switch; Experimental; Theory; Analytical Solution.

Secondary Keywords: Plasma Injector.

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6694
(BREAKDOWN STUDIES)**

(Gas; Electron)
TRANSITION FROM A NON-SELF-SUSTAINED VOLUME DISCHARGE MAINTAINED BY A BEAM OF FAST ELECTRONS TO A SPARK DISCHARGE
Yu. I. Bytchkov, S.A. Gorkin, Yu. D. Korolev, J.A. Masyatov, V.G. Rabotkin and A.G. Fil'kov
Institute of High Current Electronics, Academy of Sciences of the USSR,
Moscow, USSR.
Soviet Physics Journal, Vol. 21, No. 10, pp 1375-1377 (10/1978).
Trans. From *Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika* 21, 146-148 (October 1978).

Non-self-sustained current regimes are an efficient way of obtaining volume discharges with considerably wider ranges of gas pressure and burn duration. By applying lower voltages than the breakdown voltage to the discharge gap, it is possible to obtain a stable volume discharge maintained by a beam of fast electrons and lasting approximately 10^{-4} sec or longer. However, in this regime the amount of energy which can be fed to the discharge is also limited by formation of a spark channel. In this paper we report observations of the dynamics of the formation of a spark channel in a volume discharge excited by an electron beam. The discharge gap was in nitrogen at atmospheric pressure. The interelectrode gap was 6 cm long and was formed by a 8.5-mm-diameter Duralumin anode and a convex steel mesh with a grid size of 2×2 mm. Electrons were injected from the cathode end through a 4×4 cm window. An accelerator with a plasma-electron source similar to that described previously was used. The electron current pulse was triangular with a fast rise time ($T_{1/2} \approx 5$ microseconds) and a slow decay (the half maximum duration of the current was 150 microseconds). The peak current density of the beam at the entrance to the gas discharge gap was $\approx 2.3 \text{ MA/cm}^2$, and the accelerating voltage was 230-250 kV. 9 Refs.

Primary Keywords: Non-self-sustained Discharge; Volume Discharge; Electron Sustained Discharge; Arc Transition; Nitrogen Gas; Irregular Current Pulse

COPYRIGHT: 1978 PLENUM PRESS. REPRINTED WITH PERMISSION

**6695
(PULSE GENERATORS; POWER CONDITIONING)**

(Flux Compression; Pulse Transformers)
USE OF AN EXPLOSIVE MAGNETIC GENERATOR TO SUPPLY A GAS DISCHARGE
A.E. Vol'kenko, E.P. Matochkin and B.A. Tabachnikov
Institute of Nuclear Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR

Instrumentation And Experimental Techniques, Vol. 16, No. 3, pp 866-867 (06/1973).

Trans. from *Pribyty i Tekhnika Ekspertizy* 3, 177-178 (May-June 1973). A device is described which consists of an explosive magnetic generator acting as a current source, a matching transformer, and a resistive load. A gas discharge was used as the load. The experiments were carried out under laboratory conditions. 9 Refs.

Primary Keywords: Explosive Magnetic Generators; Matching Transformer; Gas Discharge; 50 Microsecond Generator Operating Time; Pulsed Electrical Light Sources

COPYRIGHT: 1973 PLENUM PRESS. REPRINTED WITH PERMISSION

**6696
(SWITCHES; CLOSING)**

(Gas; Solid Materials)
A THEORY OF THE PRODUCTION OF ELECTRODE VAPOR JETS BY SPARKS AND ARCS
W. Finkelnburg
Engineering Research and Development Lab., Fort Belvoir, VA

Physical Review, Vol. 174, No. 10, pp 1475-1477 (11/1968).

Ionization of the surfaces of mercury and carbon electrodes and the subsequent production of vapor jets are discussed. The theory presented is found to agree closely with the experimental values for the vapor jet velocity. Further theoretical predictions are made for vapor jet production based on the atomic properties of the electrode material. 6 Refs.

Primary Keywords: Vapor Jet; Anode Jet; Cathode Jet; Mercury Arc; Thermal Considerations

COPYRIGHT: 1968 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION

**6701
(ELECTROMAGNETIC FIELD GENERATION)**

(Magnetic)
AN EXPLOSIVE-DRIVEN HIGH-FIELD SYSTEM FOR PHYSICS APPLICATIONS

P.S. Caird, W.B. Gern, D.B. Thompson and C.M. Fowler
Los Alamos National Labs., Los Alamos, NM 87545
Journal of Applied Physics, Vol. 37, No. 1, pp 781-782 (03/1966).

A simple explosive-driven flux compression system is described for producing magnetic fields in the MG range. The current-trapping device is a seamless hollow stainless steel cylinder driven by a ring of explosive. The initial field is produced by a coil pair supplied by a 90-kJ capacitor bank. The explosive current is accounted during implosion; the experimental voltage is free of all electrostatic drifts and asymmetries. Peak fields of 1.2 and 4 MG are achieved in working diameters of 8.9 and 17 mm, respectively. The usable length is about 15 mm at these fields. Several possible applications are mentioned. 2 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression; Explosive-Driven; Stainless Steel Cylinder; 4 MG Fields

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**6704
(ELECTROMAGNETIC FIELD GENERATION)**

(Magnetic)
ANALYSIS OF FLUX COMPRESSION EXPERIMENTS III

T. Erber (1), H.G. Lotzel (1), J.E. Kennedy (2), and S.M. Praestein (3)
(1) Institut Fur Theoretische Physik, Universitat Graz
(2) Illinois Institute of Technology, Chicago
(3) Argonne National Lab., Argonne, IL

Acta Physica Austriaca, Vol. 32, No. 4, pp 314-333 (01/1970). This is the third of a series of three papers on magnetic compression. The authors present a complete analysis of their flux compression experiments from the theory behind flux compression to analysis of data. Various specific devices are presented. 29 Refs.

Primary Keywords: Flux Compression; Toroidal; Stages Of Flux Compression; Experiments; Theory

COPYRIGHT: 1970 SPRINGER VERLAG

6718

ENERGY AND TECHNOLOGY REVIEW

Lawrence Livermore Lab., Livermore, CA 94550
'05/1981)

Availability: UCRL-52000-81-5

NTIS

Research programs at LLNL are reviewed. This issue discusses validation of the pulsed-power design for FXR, the NOVA plasma shutter, thermal control of the MTTF superconducting magnet, a low-energy X-ray spectrometer for pulsed-source diagnostics, micromachining, the electronics engineer's design station, and brazing with a laser diode torch. (ERA citation 06:024019)

Primary Keywords: Lawrence Livermore Laboratory; Cooling Systems; Electrical Engineering; High-voltage Pulse Generators; Machining; Optical Systems; Research Programs; Shutters; Superconducting Magnets; X-ray Spectrometers

Secondary Keywords: ERDA/420300; ERDA/420800; ERDA/420201; NTISDE

6726

(DIAGNOSTICS AND INSTRUMENTATION; SWITCHES; CLOSING)

(Systems; Gas Gaps; Systems)
AROLE-A SIMPLE DEVICE FOR SIMULTANEOUS MEASUREMENT OF BREAKDOWN TIMES OF MANY SPARK GAPS

G. Postegna

Padova University, Padova, Italy

The Review of Scientific Instruments, Vol. 37, No. 1, pp 65-68 (01/1966)

A simple device, which enables one to observe on a single oscilloscope trace the individual breakdown times of many spark gaps in parallel. It employs signals from magnetic probes placed near each spark gap. For illustration the signals of typical breakdown conditions are shown and briefly discussed on the basis of some qualitative remarks on the behavior of a fast discharge capacitor bank. 6 Refs.

Primary Keywords: Magnetic Probes; Addition Of Several Signals; Spark Gap Monitoring; Parallel Spark Gap Operation

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

6733

(PULSE GENERATORS; POWER CONDITIONING)

(Capacitor Banks; Pulse Transformers)

HIGH VOLTAGE IMPULSE SYSTEM

D. Finkelstein, P. Goldberg and J. Shuchatowitz

Yeshiva University of New York, NY 10333

The Review of Scientific Instruments, Vol. 37, No. 2, pp 159-162 (02/1966)

An alternative to the Marx circuit for the production of high voltage, high current pulses is developed. It employs a hetero-insulated spiral-wound stepup transformer to go from a capacitor bank charged to 100 kV to an output of 1 MV. A method for using such a transformer to pulse charge a second capacitor bank efficiently without very tight coupling is derived. It is shown that for total transfer of energy (except for dissipation) the two resonant frequencies of the primary and secondary LC circuits (each measured with the other circuit open) should be equal, while the two normal mode frequencies of the coupled circuit should be in the ratio of 2:1, implying a coupling coefficient of 3/5. The design and operation of such a system is described. 3 Refs.

Primary Keywords: Pulse Generator; Capacitor Bank; Spiral Wound Transformer; Resonant Pulse Charging; 2:1 Transformer Ratio

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

6741

(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

MAGNETIC FLUX COMPRESSION BY MAGNETICALLY IMPLDED METALLIC FOILS

E.C. Shore

Sandia Labs., Albuquerque, NM 87151

Journal of Applied Physics, Vol. 37, No. 10, pp 3812-3816 (09/1966). A 136-kJ capacitor-bank energy source was used to implode metallic foils in a theta-pinch. Aluminum foils accelerated by this scheme attained a velocity of $2.3 \text{ mm/microsecond}$ and a capacitive-to-magnetic energy conversion efficiency of 23%. The upper limit for the foil velocity depends upon the foil thickness and together with a parameter which accounts for electrical heating of the foil. This parameter was determined in exploding wire studies. Experiments with and without auxiliary injection of magnetic flux are described. Thick, imploding foils have been found to be capable of compressing incident magnetic flux to more than 2 MG. 9 Refs.

Primary Keywords: Imploded Metallic Foils; 136 kJ Capacitor-bank Energy Source; 2.3 mm/microsecond Aluminum Foil Velocity; Megagauss Magnetic Fields; Theta-pinch Arrangement; 2 MG Magnetic Flux Compression; Numerical Mathematical Model

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

6747

(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

MEGACOSS PHYSICS

C.M. Fowler

Los Alamos National Labs., Los Alamos, NM 87545

Science, Vol. 180, pp 261-267 (04/1973).

The generation and application of megagauss magnetic fields is the subject of this paper. Field generation by capacitor discharge and flux compression are considered briefly with the main thrust concentrated on applications. Several experiments are described briefly, which require the use of high magnetic fields. 51 Refs.

Primary Keywords: Magnetic Field Generation; Solenoid; Flux Compression; Application; High Pressure Physics; Particle Physics

COPYRIGHT: 1973 AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

6750

(PULSE GENERATORS; SWITCHES; CLOSING; SWITCHES; OPENING)

(Solid Dielectric; Electrical; Explosive Fuses)

METHOD OF PRODUCING A FAST CURRENT RISE FROM ENERGY STORAGE CAPACITORS

H.C. Early and F.J. Martin

University of Michigan, Ann Arbor, MI

The Review of Scientific Instruments, Vol. 36, No. 7, pp 1000-1002 (07/1965)

A rate of current rise of the order of 10^{12} A/sec can be produced by the explosive conductors used in conjunction with a special low impedance fuse and spark gap. The capacitors are discharged through the fuse until the current reaches a certain maximum value at which time the current is transferred from the fuse into a load inductance of 10^{-6} henry . The spark gap isolates the load until the moment of current transfer. The current rise is limited by the inductance of the load and the inductor itself.

Primary Keywords: Capacitor Bank; Solid Dielectric Switch; Melting Current; Inductor; Inductance Independent

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**6759
(ELECTROMAGNETIC FIELD GENERATION)**

(Magnetic)

PRODUCTION OF VERY HIGH MAGNETIC FIELDS BY IMPLOSION

C.M. Fowler, W.B. Gann and R.S. Caird

Los Alamos National Labs, Los Alamos, NM 87565

Journal Of Applied Physics, Vol. 31, No. 3, pp 588-594 (03/1960).

Magnetic fields are produced in the 10-15 megagauss range by use of high explosives which compress the flux obtained from initial fields of approximately a hundred thousand gauss. The fields described here occupy a cylindrical volume and are essentially axial. A typical field might have these general characteristics: Peak field 14 megagauss; 2 microseconds duration; from 10-14 megagauss; field volume around peak, 6 mm diameter, 50 mm estimated length; 6 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression;

Explosive Driver; 14 MG Field; 100 KG Pump Field

COPYRIGHT: 1960 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**6772
(INSULATION, MATERIAL; BREAKDOWN STUDIES)**

(Liquid; Liquid; Electrical)

COMPARISON OF THE DIELECTRIC PROPERTIES OF NORMAL AND HEAVY WATER,

ABSORBED ON ZEOLITES

B.A. Glezon, M.M. Dubinin and I.I. Zhilenkov

Veronezh Agricultural Institute and Institute of Physical Chemistry,

Academy of Sciences of the USSR
Bulletin Of The Academy Of Sciences, USSR. Division Of Chemical Science,
No. 5, pp 956-959 (05/1967).

Trans. From: Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya 5,

987-990 (May 1967)

A study of the dielectric properties indicated that the relaxation times of heavy water and heavy ice are greater than those of normal water and ice. We have found that in hydrated NaA zeolite there are two relaxation processes (which we denoted at I and II), caused by the presence of water. A study by the dielectric method revealed that the relaxation times of the adsorbed water are intermediate between the relaxation times of liquid water and ice. It is therefore natural to expect that the relaxation maximum caused by adsorbed water will be displaced toward lower frequencies if normal water is replaced by heavy water. 19 Refs.

Primary Keywords: Water; Heavy Water; Hydrated Zeolite; Conductivity

Measurement; Relaxation

COPYRIGHT: 1967 PLENUM PRESS. REPRINTED WITH PERMISSION

**6789
(PULSE GENERATORS)**

(Line Type)

A GENERATOR OF CURRENT PULSES OF ADJUSTABLE SHAPE AND DURATION FOR SUPPLYING GAS-DISCHARGE TUBES

S.A. Vitsinskii, V.I. Kulakov and V.M. Opre

Instruments And Experimental Techniques, Vol. 23, No. 1, pp 121-123

(02/1980).

Trans. From: Pribory i Tekhnika Eksperimenta 1, 123-124

(January-February 1980)

A generator of current pulses of adjustable shape and duration, built on the basis of an artificial long line with ignition dischargers in sections of the line, is described. The generator allows one to obtain current pulses of different shapes and an amplitude of up to 10 kA in a gas-discharge load. Discrete regulation of the duration of the current pulse from 300 to 600 microseconds with an interval of 100 microseconds is possible. 5 Refs.

Primary Keywords: Pulse Generator; Artificial Long Line; Variable

Pulse Shape; 10 kA Output Current; 300-600

Microsecond Pulse Duration

COPYRIGHT: 1980 PLENUM PRESS. REPRINTED WITH PERMISSION

**6790
(POWER CONDITIONING)**

(Pulse Transformers)

A HIGH-VOLTAGE CABLE TRANSFORMER FOR PRODUCING STRONG PULSED CURRENTS

V.G. Gaaze and G.A. Shneerson

Instruments And Experimental Techniques, No. 6, pp 1413-1418 (12/1965).

Trans. From: Pribory i Tekhnika Eksperimenta 6, 105-110

(November-December 1965)

The basic calculation principles are discussed and designs are given for step-down cable transformers with a primary voltage of up to 150 kV for producing current pulses of up to 3 MA 5 Refs

Primary Keywords: Step-down Cable Transformers; 150 kV Primary

Voltage; 3 MA Current Pulse; High-voltage Coaxial

Cable; Leakage Inductance Reduced; Insulation

Problem Solved

COPYRIGHT: 1965 PLENUM PRESS. REPRINTED WITH PERMISSION

**6793
(ENERGY STORAGE, MECHANICAL)**

(Rotating Machines)

ACYCLIC GENERATORS WITHOUT A FERROMAGNETIC MAGNETIC CIRCUIT FOR SUPPLYING ELECTROPHYSICAL APPARATUS USED IN MHD RESEARCH

B.L. Alishevskii, A.I. Burtsev and A.G. Slobodchikov

Magnetohydrodynamics, Vol. 3, No. 1, pp 87-91 (12/1967).

Trans. From: Magnitnaya Gidrodinamika 3, 135-142 (1967)

The authors discuss a method of calculating generator electromagnetic characteristics that utilizes the idea of the mutual inductance of annular field coils of finite cross section and a cylindrical or disk armature. 11 Refs.

Primary Keywords: Acyclic Generators; Generator Electromagnetic

Characteristic Calculation; Annular Field Coils;

Liquid-metal Current Collection; Strong Magnetic

Fields; Equivalent Loop Method

COPYRIGHT: 1967 PLENUM PRESS. REPRINTED WITH PERMISSION

**6799
(ENERGY STORAGE, CAPACITIVE)**

(Capacitor Banks)

CAPACITOR BATTERY FOR ONE MEGAJOULE HAVING A SMALL TIME CONSTANT

V.A. Burtsev, V.N. Litunovskii, V.F. Prokopchenko and G.M. Marcov

Instruments And Experimental Techniques, Vol. 22, No. 6, pp 1056-1059

(08/1979).

Trans. From: Pribory i Tekhnika Eksperimenta 4, 167-170 (July-August 1979)

A capacitor battery for one megajoule is described which is made up with type IM-50/3 capacitors in a modular arrangement. The battery parameters are: Capacity 654 microfarads; self-inductance 4 nH; natural period 12 microseconds; and short-circuit current 24 MA. 6 Refs.

Primary Keywords: Capacitor Bank; 1 MJ Energy Storage; 24 MA Output

Current; 4 nH Inductance; Modular Construction;

Solid Dielectric Switch

COPYRIGHT: 1980 PLENUM PRESS. REPRINTED WITH PERMISSION

**6800
(ENERGY STORAGE, INDUCTIVE; PULSE GENERATORS)**

(Systems; Flux Compression)

CHARGING OF AN INDUCTIVE ACCUMULATOR FROM AN EXPLOSIVE-TYPE MAGNETIC

GENERATOR THROUGH AN ELECTRICAL EXPLOSIVE-TYPE CURRENT BREAKER

L.S. Gerasimov, V.I. Ilyayevnikov and A.I. Pinchuk

Novosibirsk, USSR

Journal Of Applied Mechanics And Technical Physics, Vol. 15, No. 5, pp

693-697 (10/1974).

Trans. From: Zhurnal Prikladnoi Tekhnicheskoi Fiziki 15, 132-137

(September-October 1974)

Analytical investigations were made of electromagnetic processes with the work of an explosive-type magnetic generator in a series-connected inductive type accumulator and a current breaker based on an exploding wire. A solution is obtained in dimensionless form for a model of current breaker based on an ohmic resistance, whose value rises linearly with the temperature. The conditions are determined under which an inductive load can be connected in parallel to the current breaker; under these circumstances, the current of the load branch remains small during the whole charging stage. 6 Refs.

Primary Keywords: Inductive Accumulator; Explosive-type Magnetic

Generator; Electromagnetic Processes; Current

Breaker; Ohmic Resistance

COPYRIGHT: 1974 PLENUM PRESS. REPRINTED WITH PERMISSION

**6815
(BREAKDOWN STUDIES)**

(Exploding Foil)

ELECTRICAL CONDUCTIVITY OF AN ALUMINUM FOIL IN AN ELECTRICAL EXPLOSION

A.P. Balakov, L.S. Gerasimov and A.M. Iskold'skii

Institute Of Automation And Electrometry, Academy of Sciences of the

USSR, Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 29-32 (07/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 49-55 (January 1975)

In a study of the electrical conductivity of aluminum foil as energy is rapidly supplied to it during an electrical explosion, it has been established that the function dependence of the foil resistance on the specific energy changes with the energy supply rate. This behavior had been observed in an earlier study of exploding wires. The present experimental results are in good agreement with the model of surface evaporation of wires. A possible physical mechanism for the electrical explosion of foils is offered. 10 Refs.

Primary Keywords: Electrical Conductivity; Foil Resistance; Electrical

Expllosion Of Foils; Surface Evaporation Wave Model

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**6817
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)**

(Systems; Explosive Fuses)

ENERGY TRANSFER FROM AN INDUCTIVE STORAGE BY MEANS OF AN EXPLOSIVE

CURRENT DISCONNECT

L.S. Gerasimov, A.M. Iskold'skii, Yu.E. Nesterikhin and V.K. Pinus

Novosibirsk, USSR

Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 1, pp

67-71 (02/1975).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1,

60-65 (January-February 1975)

Energy transfer from an inductive storage is considered for two types of systems: disconnecting the an intrinsic parasitic inductance from an inductive load and a pure resistive disconnect for a resistive load. Solutions are obtained for the voltage, power, and energy transferred to the load. The dependence of the efficiency of the device on its parameters is established. 4 Refs.

Primary Keywords: Inductive Storage; Explosive Current Disconnect;

Energy Transfer; Efficiency Dependence On

Parameters; Parasitic Inductance; Theory

COPYRIGHT: 1975 PLENUM PRESS. REPRINTED WITH PERMISSION

**6819
(BREAKDOWN STUDIES)**

(Exploding Wires)

EXPLODING WIRES WITH HIGH ENERGY INPUT

A.P. Balakov, A.M. Iskold'skii and Yu.E. Nesterikhin

Institute Of Automation And Electrical Measurements, Academy of

Sciences of the USSR, Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 18, No. 1, pp 87-89 (07/1973).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 136-140 (January 1973)

The explosion of tungsten wires has been observed with an oscilloscope and by synchronous photography at energy input rates of about approximately $10^{10} - 10^{11}$ J/g sec. When $dW/dt > 10^{10}$ J/g sec, the electrical explosion (for a diameter of 10^{-3} cm) occurs without magnetohydrodynamic instabilities. It is found that the resistance near the point of impact is reduced when the energy input rate is increased. A criterion is derived for this effect. 5 Refs.

Primary Keywords: Electrically Exploded Tungsten Wires; $10^{10} - 10^{11}$

J/g Energy Input Rates; Magnetohydrodynamic

Instabilities; Phase-transition Point Resistance

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**6826
(PARTICLE BEAMS; ELECTRON)**

(Generation)

HIGH-CURRENT ELECTRON ACCELERATOR FOR OPTICAL PUMPING OF GASES

G.R. Badalyan, V.A. Manikyan, G.T. Morsyan and V.O. Paparyan

Institute Of Physical Studies, Academy of Sciences of the Armenian SSR, Ashtarak, USSR

Soviet Technical Physics Letters, Vol. 4, No. 11, pp 543-544 (11/1978).

Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1349-1351

(November 1978)

Recent years have seen progress in the use of high-current electron beams to produce high-pressure gas lasers for the UV and vacuum-UV ranges. A high-current source of square electron pulses developed for this purpose has an electron energy which can be varied over the range 0.3-0.7 MeV, a pulse length of 30 nsec, and a current density (in the high-pressure laser chamber) of 40-100 A/cm². This electron accelerator uses a rectangular cold cathode with an anode located some distance below the surface of a dielectric with a high value of residual vacuum pressure. It has been carried out with cathodes of stainless steel, copper, and graphite. 6 Refs.

Primary Keywords: Beam Generation; Field Emission Diode; Several

Cathode Materials; 700 keV Beam Energy; 100 A/cm².

Current Density

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

6830
(BREAKDOWN STUDIES)
(Exploding Wires)

INITIAL STAGES OF THE ELECTRICAL EXPLOSION OF A WIRE IN AN LC-LOOP
L.S. Gerasimov, V.I. Pinchuk and Yu.A. Stukaln
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 6, pp
721-727 (12/1978)

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6,
18-25 (November-December 1978)

A great amount of work has been devoted to the investigation of the phenomenon of the electrical explosion of a wire, and several models have been proposed to explain its physical mechanism. The fact that there is no single generally accepted point of view indicates that with respect to the phenomenon of the electrical explosion of a wire, all is not yet clear. However, it cannot be disputed that the essence of the phenomenon of the electrical explosion of a wire is competition between the processes: the breakdown of the wire as a whole and the accompanying loss of electrical conductivity, on the one hand, and the evolution of Joule heat, on the other hand. Here the mechanism of the breakdown itself is determined by the rate of introduction of energy, from what has been said it is clear that the more rapid an electrical explosion and its physical mechanism are determined by the rate of introduction of energy. A change was observed on a previous article in the character of an electrical explosion as a function of the rate of heating of the liquid phase. The present article poses the problem of the determination of this rate from the initial conditions of the experiments. 16 Refs.

Primary Keywords: Electrical Explosion; Wire Breakdown; Electrical Conductivity Loss; Joule Heat Evolution; Energy Introduction Rate; Quasi-steady-state Heating Model; Theory

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

6832
(BREAKDOWN STUDIES)
(Liquid, Electrical)

INVESTIGATING PREBREAKDOWN FIELDS IN WATER BY MEANS OF THE KERR EFFECT
I.T. Ovchinnikov, K.V. Yanshin and E.V. Yanshin
Institute Of Automation And Electrometry, Academy of Sciences of the

USSR, Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 19, No. 2, pp 294-295 (08/1974).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 172-174 (February 1974).
The electric field distribution in the gap formed by extended electrodes is investigated in fields of 1.3 MV/cm. Space charge, which can distort the field in the gap, is not formed for 200 nsec (measurement error of 0.3%). 5 Refs.

Primary Keywords: Prebreakdown Field Investigation; Kerr Effect; 1.3 MV/cm Fields; Space Charge; Electric Field Distribution; Polarity Effect

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6834
(ENERGY STORAGE, CAPACITIVE)
(Capacitor Banks)

LOW-INDUCTANCE CAPACITOR MODULE FOR CHARGING TO 100 KV AND ENERGY

STORAGE CAPACITY 80 kJ

A.B. Andrezen, V.A. Burtsev, V.M. Vodovozov, A.A. Drozdov and G.M.

Mokshin
Instruments And Experimental Techniques, Vol. 23, No. 2, pp 407-410

(06/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 2, 109-112 (March-April 1980).

The construction is described of a capacitor module which charges to 100 kV and is equipped with two dischargers with a solid dielectric, a system for triggering the dischargers with insulation from the control circuits effective to 100 kV DC, and a system for guarding and automatically charging the capacitors. The proper period of discharging of the module is $T_{\text{sub}} \approx 5.6$ microseconds. The capacitor module was used in experiments studying electrical explosion of flat Al foils in pulverized quartz. An overvoltage U_{sub} divided by U_{sub} of approximately 10 was obtained at a maximal electric field intensity E_{sub} of approximately 12 kV/cm. 3 Refs.

Primary Keywords: Capacitor Bank; Module Construction; Solid Dielectric Switch; 100 kV Output Voltage; Exploding Foil; Quartz Environment

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

6835
(PULSE GENERATORS)
(Marx)

LOW-INDUCTANCE GENERATOR OF PULSED VOLTAGE AT 1 MV

G.I. Koba, Yu.V. Koba, I.N. Sil'nikov, A.P. Sukhoruk and E.Z. Tarumov

Instruments And Experimental Techniques, Vol. 23, No. 3, pp 115-119

(02/1980).
Trans. From: Pribory i Tekhnika Eksperimenta 1, 117-120

(January-February 1980).
A high-voltage generator of pulsed voltage, built on the Arkad'ev-Marx scheme, for a voltage of 1 MV and an energy of 12 kJ with a discharge circuit inductance of 1.3 microhenry is described. The low inductance of the generator is obtained through the use of low-inductance capacitors and a system of double-wound coils. A firing system based on resistive coupling between stages of the generator, based on controllable three-electrode dischargers with field distortion, was developed for reliable triggering of the generator. 5 Refs.

Primary Keywords: Marx Generators; Low Inductance Circuit; Double-wound Interconnections; Field Distortion Spark Gap; All Stages Triggered

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

6836
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

LOW-PRESSURE GAS-DISCHARGE COMMUTATORS

I.I. Aksenov and S.A. Starov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR,

Khar'kov, USSR
Instruments And Experimental Techniques, Vol. 15, No. 3, pp 945-946

(06/1972).
Trans. From: Pribory i Tekhnika Eksperimenta 3, (May-June 1972).
The paper presents the results of investigating a sealed gas-spark gap device with a cold cathode for commutating powerful current pulses. Tests for service life were made on the device proposed by the authors, which had a hollow cathode and was controlled by a pulse glow discharge, and on a vacuum spark gap having several versions of a trigger starting device. 3 Refs.

Primary Keywords: Sealed Gas-spark Gap Device; Low Pressure; Hollow Cathode; Cold Cathode; Strong Electrode

Effect on Long Service Life; Erosion

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

6837
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic Flux Compression)

MAGNETIC ACCUMULATION IN A PLANE LINER OF FINITE THICKNESS

L.S. Gerasimov and V.I. Ikrayannikov

Institute Of Automation And Electrometry, Academy of Sciences of the

USSR, Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 23, No. 2, pp 147-149 (02/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 244-248 (February 1978).

The diffusion loss of magnetic flux in magnetic accumulation in a plane, uniform liner of finite thickness is studied. This loss is shown to depend on the degree of compression, the nature of the pump, and two magnetic Reynolds numbers. When the liner is thin the flux loss is independent of the nature of the pump, being governed only by a single Reynolds number. An equivalent circuit for the system is proposed. 5 Refs.

Primary Keywords: Flux Compression; Magnetic Flux Loss; Magnetic Accumulation; Plane Uniform Liner; Magnetic Reynolds Number; Theory

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6838
(PULSE GENERATORS)

(Flux Compression)

MAGNETIC ACCUMULATION IN A TAILORED-PROFILE, PLANE, EXPLOSIVE-MAGNETIC GENERATOR WITH ARBITRARY LOAD

L.S. Gerasimov and V.I. Ikrayannikov

Institute Of Automation And Electrometry, Academy of Sciences of the

USSR, Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 23, No. 7, pp 859-861 (07/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1520-1524 (July 1978).

The flux loss of magnetic flux is studied in magnetic accumulation in a tailored-profile, plane, explosive-magnetic generator with an arbitrary load. A method for constructing the equivalent circuit of the device is studied for the inductive and resistive loads. Flux diffusion is taken into account. The profile is optimized for the inductive load. The profile need not be corrected for diffusion with a resistive load. 5 Refs.

Primary Keywords: Flux Compression; Optimum Profile; Arbitrary Load; Diffused Magnetic Flux Loss; Magnetic Accumulation; Tailored-profile Explosive-magnetic Generator

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6839
(PULSE GENERATORS; POWER CONDITIONING)

(Flux Compression; Pulse Transformers)

MATCHING AN EXPLOSIVE-MAGNETIC GENERATOR TO A RESISTIVE LOAD USING A TRANSFORMER

L.S. Gerasimov

Novosibirsk, USSR

Journal Of Applied Mechanics And Technical Physics, Vol. 19, No. 4, pp

460-463 (08/1978).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4,
50-54 (July-August 1978).

The use of explosive-magnetic generators in modern technology and scientific investigations as pulsed generators of high-power electrical energy has been discussed previously. The circuit for directly connecting the explosive generators into a resistive load is the simplest and most convenient, but it has limitations both with respect to the value of the load resistance and with respect to the value of the voltage developed. In this connection, in a current breaker is regarded as a necessary element in the circuit of an explosive electrical generator. We show below that the use of a pulsed matched transformer enables one to reduce these limitations considerably and to obtain satisfactory matching in many cases between the explosive-magnetic generator and a resistive load without a current breaker. 7 Refs.

Primary Keywords: Resistive Load; Explosive-magnetic Generators; Pulsed Matched Transformer; No Output Switch; Design Considerations

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

6840
(SWITCHES, CLOSING)
(Class)

MULTICHANNEL SEMICONDUCTOR NANOSECOND SWITCH FOR EXCITATION OF COPPER

VAPOR BY A TRANSVERSE DISCHARGE

V.M. Alekseev, D.I. Buzhinskii, I.V. Grekhov, M.E. Levinstein, A.I.

Mukhamed and V.G. Sergeev

All-Union Physicotechnical Institute, Academy of Sciences of the

USSR, Leningrad, USSR

Soviet Journal Of Quantum Electronics, Vol. 11, No. 1, pp 111-113

(01/1981).
Trans. From: Kvantovaya Elektron 8, 191-193 (January 1981).

A high-power semiconductor nanosecond switch, in the form of a thyristor structure activated by a laser pulse, was investigated. This switch could handle currents up to approximately 5×10^4 A under voltages of > 5 kV in a time of approximately 1 nsec. The principle of its operation ensured synchronous triggering of several switches with an accuracy of 0.1-0.01 nsec. These switches could be connected in series and could be used effectively to pump lasers excited by transverse discharges. 11 Refs.

Primary Keywords: Thyristor; Multichannel; Laser Triggering; Very Low Current; Parallel Operation; Series Operation

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6841
(ELECTROMAGNETIC FIELD GENERATION)

(Radio)

CREATING POWERFUL MAGNETIC FIELDS BY MEANS OF A POWERFUL CAPACITOR BANK

A.I. Pavlovich, E.N. Smirnov and V.N. Sverdlov

Instruments And Experimental Techniques, Vol. 18, No. 3, pp 932-934

(06/1975).
Trans. From: Pribory i Tekhnika Eksperimenta 3, 214-216 (May-June 1975).

A field having an intensity of 1.9 Moe in a volume approximately 1 cu cm with a rise time approximately 10 microseconds was obtained in the discharge of a powerful MKB-1 capacitor bank having an energy capacity of 1.35 MJ. A qualitative analysis is made of the surface effect in a cylindrical current-carrying conductor; it is noted that for a field approximately 1.7 Moe the explosion of the current-carrying layer is observed. 3 Refs.

Primary Keywords: Magnetic Field Generation; Capacitor Bank Voltage Source; One-turn Solenoid; Low Inductance; Field Diffusion; Peak Field Reduction

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

- 6842
(BREAKDOWN STUDIES)
(Electrolytes, Electrical)
ON THE NATURE OF PULSE ELECTRIC BREAKDOWN OF AQUEOUS ELECTROLYTES
V.Ya. Usachov, O.P. Semkina and V.V. Ryumin
Academy of Sciences of the USSR, Tomsk, USSR
Applied Electrical Phenomena, No. 2, p. 31-42 (04/1972).
Trans. From: Elektronika i Obrabotka Materialov 2, 48 (1972).
The basic characteristics of aqueous electrolytes are presented in this paper. The effect of conductivity on pulsed breakdown voltage and delay is presented for highly nonuniform fields in electrolytes 100-1E6 ohm-cm. Voltage pulses in the range of 10 ns to 50 microseconds are used. A model for pulsed electrolyte breakdown is proposed. 15 Refs.
Primary Keywords: Aqueous Electrolytes; Pulse Electrical Breakdown; Electric Strength; Discharge Duration Time; Discharge Development Studies; Ionic Conductivity
COPYRIGHT: 1972 SCIENTIFIC INFORMATION CONSULTANTS, LTD.
- 6850
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Self, Gas, Electrical)
PULSED BREAKDOWN OF SMALL GAPS IN THE NANOSECOND RANGE
Yu.E. Nestorovich, V.S. Kondrakov and E.Z. Melikhov
Soviet Physics Technical Physics, Vol. 9, No. 1, p. 29-39 (07/1964).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 40-52 (January 1964).
Breakdowns in the nanosecond range are interesting not only because of the numerous practical applications (fast circuits, circuits for shaping pulses with steep fronts, etc.), but also because the times of certain elementary processes (for instance, the processes of deexcitation of excited molecules, cumulative increase, etc.) are in this range commensurable with the time of the phenomenon itself. This fact produces a noticeable effect on the statistics of the breakdown lag time, which does not conform to the usual normal distribution. In contrast to Fletcher's experiments, we used pulses with steeper fronts, high-resolution equipment, and variation of the gas pressure in the gap, which made it possible to determine breakdown lag time by with overvoltages higher than those in earlier investigations. 14 Refs.
Primary Keywords: Spark Gap; Nanosecond Range Breakdowns; Breakdown Lag Time; Steeper Fronts; High-resolution Equipment; Gas Pressure Variation.
COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 6857
(BREAKDOWN STUDIES)
(Gas, Electrical)
SPARK DISCHARGE EMISSION IN HELIUM
M.P. Yanukov, A.A. Mak and V.P. Muraev
Optics And Spectroscopy, Vol. 8, No. 4, pp 233-236 (04/1960).
Trans. From: Optika Spektroskopii 8, 439-445 (April 1960).
This paper reports the spectroscopic study of a high-pressure (2.5-12 atm) discharge in helium. The spectrum is divided into two categories: spark lines, which occur at the initiation of the discharge; and air lines, which occur later. The temporal profile of the spectrum is presented. The authors present an estimate of electron density as a function of time. 15 Refs.
Primary Keywords: Breakdown Study; Helium; Emission Spectrum; Temporal History; Electron Density
COPYRIGHT: 1960 AMERICAN OPTICAL SOCIETY
- 6858
(BREAKDOWN STUDIES)
(Gas, Electrical)
STABILIZATION OF A PINCHED HIGH-CURRENT DISCHARGE BY MEANS OF A PLASMA JET
V.B. Voronich, N.N. Ogurtsova, I.V. Podmoshenskii and P.M. Rogovtsov
Soviet Physics-Technical Physics, Vol. 25, No. 5, pp 608-611 (05/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 30, 1009-1014 (May 1980).
The feasibility of maintaining an unbounded current channel in a high-current gas discharge open to the ambient medium, for a period several times as long as the hydromagnetic instability development time, has been studied. The result was achieved by forcing a hot jet of erosion plasma up the channel. This discharge was supplied from a capacitor bank storing 150 kJ of energy. A single current pulse with an amplitude of 100-200 kA and a 30-microsecond duration was generated. These conditions give rise to a plasma current I_p of approximately 10^{15} cu. cm. and $T \approx 20,000 - 30,000$ deg K. This indicates the feasibility of developing a stable open light source with a bright plasma and a broad radiation spectrum, with a flash lasting much longer than the glow life of existing nonsteady open light sources. This phenomenon of discharge stabilization can also be utilized in PHD accelerators. 15 Refs.
Primary Keywords: Discharge Channel; Unbounded Channel; Plasma Jet Stabilization; 200 kA Discharge Current; Plasma Density Measurement; Plasma Temperature Measurement
COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 6865
(ENERGY STORAGE, MECHANICAL; ENERGY STORAGE, INDUCTIVE)
(Rotating Machines; Charging)
THE CHARGING OF INDUCTIVE STORAGE DEVICES BY MEANS OF ELECTRICAL ROTARY AGGREGATES
E.A. Zatova, I.A. Ivanov, A.I. Karasev and V.A. Trukhin
Power Engineering, Vol. 15, No. 4, pp 62-68 (01/1977).
Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 15, 69-75 (1977).
Inductive energy is a viable form of storing large amounts of energy in a small volume. The author presents a scheme for charging the inductor without loading the power grid unnecessarily. A rotary aggregate is used to supply over 100 J to the inductor at a rate exceeding 300 kHz. Power conditioning of the charging system is discussed. 4 Refs.
Primary Keywords: Electrical Rotary Aggregates; Inductive Storage Device Charging; Maximum Initial Excitation Current; $1E8-1E9$ J Energy; $1E12$ W Discharge Power
COPYRIGHT: 1977 ALLERTON PRESS, INC.
- 6869
(SWITCHES, OPENING; ENERGY STORAGE)
(Mechanical; Systems)
THE TIME REQUIRED FOR TRANSFER OF CURRENT FROM A LIQUID-METAL COMMUTATOR INTO A SHUNTING CIRCUIT
V.G. Artyukh and S.A. Smirnov
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Khar'kov, USSR
Instrumentation And Experimental Techniques, Vol. 10, No. 3, pp 819-820 (06/1975).
Trans. From: Pribory i Tekhnika Experimenta 3, 128-129 (May-June 1975).
The dependence of the time required for transfer of current into a shunting circuit on the magnitude of the current are presented which were obtained experimentally for a high-speed liquid-metal commutator for various parameters of the shunting circuit. For currents in the range from tens to hundreds of amperes this time is several or tens of microseconds. 1 Refs.
Primary Keywords: Opening Switch; Current Transfer; Shunting Circuit; High-speed Liquid-metal Commutator; Time Dependences; Eutectic Alloy
COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6872
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)
USE OF ELECTRIC EXPLOSION OF WIRES IN A HIGH-PRESSURE GAS TO BREAK A CURRENT CIRCUIT
G.P. Cizunov, V.P. Kentsedal and R.V. Mitin
Kharkov, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 17, No. 6, pp 835-847 (12/1976).
Trans. From: Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 6, 102-105 (November-December 1976).
The high energy densities stored in the magnetic field of inductive storage devices have promising applications in experimental physics. The greatest energy storage levels are achieved in superconducting storage devices, but they require large currents, operating with explosive-magnetic generators (currents up to 3E8 A). To use the energy stored in a magnetic field one must cut the current in the storage circuit and switch it to the load circuit. One method of doing this is to use a switch based on electrical explosion of wires (EEW). There are several difficulties in creating current cutoff devices of this type: After the electric explosion a column of metal vapor forms in which breakdown can occur; then the cut-off process is slowed and the energy-transfer efficiency is decreased. The problem is that the wire material is instantly vaporized, i.e., it is a dielectric subject to stresses arising when the inductive storage device is switched to the load. A series of tests has been conducted with different materials in order to elucidate the possible use of EEW in a high-pressure gas for current switching. 2 Refs.
Primary Keywords: Explosive Wires; High Energy Densities; Current Cut-off Devices; Inductive Energy Storage; Opening Switches
COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6873
(BREAKDOWN STUDIES)
(Gas, Optical)
VOLUME DISCHARGE WITH UV PREIONIZATION
V.Yu. Beranov, V.M. Bonsov, E.Sh. Hepartovich, A.P. Hepartovich, Yu.A. Satov and V.V. Sudakov
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 2, No. 3, pp 266-269 (06/1976).
Trans. From: Fiz. Plazmy 2, 486-491 (May-June 1976).
A theoretical and experimental study has been made of the influence of the parameters of the discharge power-supply circuit on the shape of the voltage and current pulses, the maximum energy of a volume discharge. Measurements were carried out in a mixture of the gases CO_2 sub 2%, N_2 sub 2%, and He , which are typical of pulsed lasers. It is found in the pure component of the mixture calculations based on a simple model for the discharge in nitrogen yield time dependences for the voltage, discharge current, and total current; the value of E/P in the plasma is also found as a function of the discharge voltage, the pressure, and the circuit parameters. The calculated and experimental data agree well, permitting the conclusion that there is no typical value of the parameter E/P for the laser mixture. This parameter is found as a function of the pressure at the circuit conditions. 12 Refs.
Primary Keywords: Gas Discharge; CO_2 sub 2%; N_2 sub 2%; He Gas Mixture; UV Preionization; Individual Gas Breakdown; Laser mix.; Theory; Voltage Measurement; Current Measurement
COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 6874
(PULSE GENERATORS)
(Flux Compression)
WORK PERFORMED BY A PLANAR EXPLOSION MAGNETIC GENERATOR ON A RESISTIVE LOAD
L.S. Gerashin and V.I. Ikryannikov
Institute of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 12, pp 1497-1501 (12/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 2583-2589 (December 1977).
The conversion of the energy of an explosive into electromagnetic energy by a planar explosion magnetic generator operating into a resistive load is studied. Optimization of an explosion magnetic generator on the basis of a specified criterion (a maximum voltage, a maximum power, a maximum energy, or a maximum energy, or a maximum efficiency) is examined. It is shown that explosion energy can only be converted efficiently at voltages below a certain value. Conversion of magnetic flux is not a necessary condition. 4 Refs.
Primary Keywords: Energy Conversion; Planar Explosion Magnetic Generator; Resistive Load; Critical Voltage Value
COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6876
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

ANALYSIS OF THE TRUMP-VAN DE GRAAFF CONDITION FOR VACUUM BREAKDOWN
V.A. Avrutskii and V.M. Koschienko
Moscow Energetics Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 9, pp 1062-1066
(09/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1889-1895 (September 1979)

The Trump-Van de Graaff breakdown condition, which is based on the emission of electrons and ions from the electrodes, is analyzed. The starting condition for the discharge implies that each electron leaving the cathode ejects a number of ions from the anode which is sufficient to eject a single electron from the cathode. Account is taken of the ionization which occurs in the gas film adsorbed on the cathode when the electrons interact with this film. Extraction of ions into the interelectrode gap by the applied field is also taken into account. Two cases are considered: two plane electrodes, with a homogeneous field between them, and the case in which there is an insulator in the interelectrode gap. The conditions for a self-sustained discharge in vacuum are obtained. These expressions on certain values which can be found from the literature and handbook. They explain the breakdown characteristics of vacuum gaps both qualitatively and quantitatively. 7 Refs.

Primary Keywords: Vacuum Breakdown; Trump-Van de Graaff Condition; Field Emission; Gas Adsorption; Parallel-plane Electrodes; Interelectrode Insulator.

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6877
(BREAKDOWN STUDIES)
(Exploding Wires)

T.J. Tucker
Sandia Labs, Albuquerque, NM 87115
Journal of Applied Physics, Vol. 42, No. 10, pp 1894-1900 (10/1971).

A square wave generator current source was used to study the behavior of gold wires exploded by current densities in the range of 0.25E8 to 3.26E8 amp./sq.cm. Measurements of wire resistance vs cumulative energy and action at various current densities are compared with a simple theoretical exploding wire model and the results of Kerr cell photographic studies. Experimentally, the total energy input to the time of maximum wire resistance increases with current density and may exceed by threefold the normal vaporization energy. Also, the instantaneous wire resistance at any point is smaller with a larger current density. The resistance depression is first apparent in the region following vaporization. At higher current densities, the effect is observed to occur at progressively earlier phases up to and including the point at which melting occurs. 7 Refs.

Primary Keywords: Exploding Wire; Gold Wire; 3E8 A/sq.cm. Current Density; Wire Resistance Measurement; Temporal Resolution; Resistance Depression.

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6878
(BREAKDOWN STUDIES)
(Liquid, Electrical)

G.B. Rakowski
CIRCUIT TRANSIENT FOLLOWING A PULSED DISCHARGE IN WATER
Soviet Physics-Technical Physics, Vol. 17, No. 9, pp 1587-1590
(03/1973).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 1982-1986 (September 1972).

The solution of the equation for a circuit that includes as an active element the spark produced following pulsed breakdown of water is analyzed. An analytic solution of the transient equation is obtained for special cases of the variation of the resistance, in which the experimental curve is approximated. This makes it possible to express the current and its derivative as functions of the time. A preliminary analysis of the limits of applicability of the results is given. 8 Refs.

Primary Keywords: Water Breakdown; Transient Equations; Underwater Pulsed Discharge; Conduction Channel Resistance; Rate Of Energy Release; Circuit Considerations.

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6880
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Electrical; Electrodes) CONDITIONS FOR SPOTTER EMISSION IN HIGH-PRESSURE SPATIAL GASEOUS DISCHARGES

Yu.D. Korolev, G.A. Mesyats and V.B. Ponomarev
Academy of Sciences of the USSR, Tomsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 20, No. 6, pp 674-678 (12/1979).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 20, 25-29 (November-December 1979).

The contraction of a high-pressure spatial gaseous discharge is associated with formation of a cathode spot and an outgrowth from the latter of a high-conductance spark channel. In an earlier study there was proposed a model of spot initiation under high electric field intensities $E(D)$ at the cathode, when spontaneous emission from individual microasperities becomes significant. Then the cathodic layer is unstable relative to fluctuations of the spontaneous-emission current so that heating of the tips by the electric current and the ion current causes this layer to sputter and a cathode spot is formed. The electric field intensity $E(D)$ is related to the ion current density j according to the law of similitude $E(D)/p = f(j/p^{1/2})$, with p denoting the gas pressure. This relation yields the dependence of the discharge current density or the pressure at a beforehand given electric field intensity $E(D)$ if $E(D)$ is sufficiently high for initiating a cathodic instability. This study will deal with the determination of the critical electric field intensities E_p and the current densities in spatial discharge at which such intensities are attained. 19 Refs.

Primary Keywords: Gas Breakdown; Cathode Spot; Cathode Sputtering; Spark Channel; Ion current; Pressure Dependence.

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

6882
(BREAKDOWN STUDIES)
(Gas, Electrical)

EFFECT OF INHOMOGENEITY OF A TRANSVERSE MAGNETIC FIELD ON BREAKDOWN
P.M. Tyurkinov, I.K. Fetisov and G.V. Khodchenko
Moscow Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 9, pp 1051-1053
(09/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1809-1814 (September 1978)

A low-pressure discharge is studied in a homogeneous electric field which is perpendicular to an inhomogeneous, axisymmetric magnetic field. The inhomogeneity of the magnetic field affects the breakdown conditions. A qualitative interpretation is offered for the experimental results. 10 Refs.

Primary Keywords: Gas Breakdown; Low Pressure; Self-breakdown; Transverse Magnetic Field; Inhomogeneous Field; Effect On Breakdown

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6883
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Surface Flashover; Solid)

ELECTRIC FIELD CONFIGURATION FOR A GRAZING DISCHARGE
P.N. Dastur and K.P. Singh
M.I. Kalin n Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 6, pp 657-668 (06/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1241-1244 (June 1979).
The grazing discharge which occurs along the surface of a dielectric, is used in high-current, low-inductance switches and in pulsed light sources. On the other hand, the grazing discharge is a major problem in the normal operation of certain insulating structures and other types of electrical devices. Despite the extensive information which is now available on the electrical and physical characteristics of the grazing discharge, we do not yet have a good picture of this discharge; this situation is in contrast with the free gas discharge which develops in a highly nonuniform field. 13 Refs.

Primary Keywords: Grazing Discharge; Surface Discharge; Closing Switch; Insulation Breakdown; Uniform Field Discharge

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6885
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Mechanical; Mechanical)

EXPERIENCE IN SWITCHING KILOAMPERE DIRECT CURRENT BY MEANS OF LIQUID METAL

V.A. Boguslavskii, I.M. Tolmachev and E.I. Yantovskii
MagnetoHydrodynamics, Vol. 8, No. 1, pp 158-159 (03/1972).

Trans. From: Magnitnaya Gidrodinamika 8, 153-154 (January-March 1972).
The most promising of current designs of liquid-metal switching devices are devices in which an electrically conducting fluid enclosed in a closed vessel takes up the positions necessary for switching an electrical circuit as in response to the action of the magnetic field associated with the control currents. The absence of mechanical wear under no load and no noiseless operation. These devices can be classified under two headings: conductive devices in which the displacement of the electrically conducting fluid is brought about through the interaction between the control magnetic field and the control current flowing through the liquid-metal contact and inductive devices where the effect is achieved through the interaction between the fluid and a pulsating field or traveling field of control circuits. We describe the results of experiments staged with an inductive device in which the electrically conducting fluid is displaced through its interaction with a rotating magnetic field. 4 Refs.

Primary Keywords: Vacuum Commutator; Liquid Metal Contact; Magnetic Field Control; Performance Test; High Reliability

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

6886
(SWITCHES, CLOSING; SWITCHES, OPENING)

(Mechanical; Mechanical)
FAST-ACTING VACUUM COMMUTATOR WITH CONNECTION BY LIQUID-METAL CONTACTS

T.G. Gal'kina, O.A. Gusev, A.G. Necheev and E.P. Pavlov
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 506-508
(04/1977).

Trans. From: Priroby i Tekhnika Ekspertiz 2, 161-163 (March-April 1977).

The construction and operating principles of a fast-acting commutator with connection by liquid-metal contacts are described. With a contact surface area of approximately 20 mm² and a resistance of no more than 3-5 microohms in the closed state, the commutator can carry a current of up to 5 kA for a long period of time and also conveys current from an inductance tank to a load of 5 ohm and 10 microhenry, with an artificial current zero in 20-30 microseconds. 2 Refs.

Primary Keywords: Vacuum Commutator; Liquid-metal Contacts; Fast Opening; 5 KA Operating Current

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

6887
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas, Electrical; Gas Gaps, Electrical)

FORMATION OF A MULTICHANNEL SPARK IN AIR

V.P. Beloshev
Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1201-1202
(10/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2180-2182 (October 1979).
A spark discharge in a gas-filled gap usually develops through a single channel; this feature makes it difficult to switch high-current circuits because with a current >IE_S A the reduction in the resistance and inductance of the channel results from its expansion while the switching time goes as $1/\tau \approx 33\mu$. Furthermore, the high resistance of the channel in the early stage leads to a substantial energy loss, especially in the early stage. Because of these circumstances, along with the significant electrode erosion at discharge currents >IE_S A, it is necessary to develop methods for forming multichannel discharges. In the present paper we propose a new method for obtaining a multichannel discharge. This method used a multichannel barrier discharge which develops in all discharge gaps with a common ignition electrode. Study of the barrier discharge shows that its multichannel structure is governed by the rate at which the grazing discharge develops along the dielectric barrier. 5 Refs.

Primary Keywords: Multichannel Discharge Formation; Multichannel Barrier Discharge; Low Inductance Switch

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6892
(BREAKDOWN STUDIES)
(Liquid, Electrical)**

INTERFEROMETRIC STUDY OF PULSED BREAKDOWN IN A LIQUID
V.F. Kimkin and A.G. Ponomarenko
Novosibirsk State University, Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 24, No. 9, pp 1067-1071
(09/1979).
Trans. From: Zurnal Tekhnicheskoi Fiziki 49, 1896-1904 (September 1979).

Certain new features have been observed in the initial stage of an electric discharge in a liquid dielectric at $E_{\text{field}}/E_{\text{breakdown}}$ approximately (0.3-1) 10^6 V/cm in an interferometer study with time resolution approximately 5E-9 sec and spatial resolution approximately 5E-4 cm. The jumps in the refractive index and the pressure are determined by solving the Abel integral equation by a stepwise-approximation method for a shock wave; behind the shock front the primary ionization processes proceed comparatively slowly. A study of the dynamics of the shock waves lead to estimates of the basic energy relations for the initial 'hydrodynamic' stage of electric breakdown in distilled water. 15 Refs.

Primary Keywords: Liquid Breakdown; Interferometric Diagnostic; Spatial Resolution; Temporal Resolution; Initial Breakdown Stages; Shock Wave

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6893
(SWITCHES, CLOSING; SWITCHES, OPENING)
(Mechanical; Mechanical)**

INVESTIGATION OF THE COMMUTATION OF A KILOAMPERE DIRECT CURRENT BY A LIQUID METAL IN A ROTATING FIELD
V.A. Boguslavskii, I.M. Tolmachev and E.I. Yantovskii
MagnetoHydrodynamics, Vol. 8, No. 4, pp 509-514 (12/1972).

Trans. From: Magnitnaya Gidrodinamika 8, 95-101 (October-December 1972).
A device for investigating the commutation of high currents by means of a liquid metal, consisting of nonconducting hemispherical cylinder partially filled with liquid metal, electrodes inserted into the cylinder, and an external iron-free inductor of rotating field, is described. On connecting the inductor the liquid metal unrolls forms a rotating conducting cylinder, and closes the main circuit. Disconnection of the inductor leads to subsidence of the liquid metal under the effect of gravity and to breaking of the circuit. Problems of a comparison of a linear device with a centrifugal device, determination of the maximum short-circuit current, and calculation of the field of an iron-free stator are discussed. Experiments on a model of a contactor with commutation of a direct current up to 1000 A at a voltage of 220 V with boosting of the control voltage upon connection and with counterrotation upon disconnection are described. 6 Refs.

Primary Keywords: Vacuum Commutator; Rotating Magnetic Field; Liquid Metal Contact; Field Closing Device

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

**6894
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)**

CROWBAR GAP SWITCH WITH TWO TRIGGERING PULSES OF OPPOSITE POLARITIES AND ITS SIMPLIFIED GAP SWITCHES

M. Ikeda and S. Takeda
Electrotechnical Lab., Tokyo, Japan
The Review Of Scientific Instruments, Vol. 41, No. 11, pp 1669-1677 (11/1970).
A crowbar gap switch with a new triggering circuit has been designed and tested. Two trigger pulses of opposite polarities are applied simultaneously. At the time of crowbar, after a quarter cycle of main current, two pulses of opposite polarities are applied simultaneously to the trigger electrodes. These trigger electrodes break down by field emission so that a breakdown path is established. The main current flows along the path and is crowbared. 0 Refs.

Primary Keywords: Spark Gap; Crowbar Gap; Oval Trigatron Configuration; Double Trigger

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6895
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, CAPACITIVE)
(Systems; Systems)**

PLASMA INJECTORS WITH CAPACITY AND INDUCTANCE ENERGY STORAGE
N.V. Belan, N.A. Mashtylev and B.I. Panchavnyi
Khar'kov Aviation Institute, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 10, pp 1642-1645 (10/1972).

Trans. From: Zurnal Tekhnicheskoi Fiziki 41, 2073-2078 (October 1971).
The acceleration of a plasmoid in an injector with capacity and inductance energy storage is treated. A system of equations is derived and solved numerically for capacity and inductive energy storage. The conditions under which an injector provides the same efficiency, regardless of the type of energy storage, are determined. 7 Refs.

Primary Keywords: Plasma Injectors; Inductive Energy Storage; Capacitive Energy Storage; Comparison; Efficiency

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6896
(BREAKDOWN STUDIES)**

TRANSIENT PHENOMENA IN A GAS DISCHARGE

V.P. Slobodchikov and V.P. Slobodchikova
Institute of Applied Mechanics, USSR

Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1133-1137 (10/1979).

Trans. From: Zurnal Tekhnicheskoi Fiziki 49, 1373-1378 (July 1979).
The author presents a theoretical explanation for the Chare effect (the electrical implosion of conducting liners for magnetic field compression). The diffusion of the field into the liner and subsequent implosion are considered on quantitative basis. 9 Refs.

Primary Keywords: Flux Compression; Electrical Liner Implosion; Theory

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6897
(BREAKDOWN STUDIES)**

TRANSIENT PHENOMENA IN A GAS DISCHARGE

V.P. Slobodchikov and V.P. Slobodchikova

Institute of Applied Mechanics, USSR

Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1133-1137 (10/1979).

Trans. From: Zurnal Tekhnicheskoi Fiziki 49, 1373-1378 (July 1979).
The author presents a theoretical explanation for the Chare effect (the electrical implosion of conducting liners for magnetic field compression). The diffusion of the field into the liner and subsequent implosion are considered on quantitative basis. 9 Refs.

Primary Keywords: Flux Compression; Electrical Liner Implosion; Theory

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6898
(BREAKDOWN STUDIES)**

TRANSIENT PHENOMENA IN A GAS DISCHARGE

V.P. Slobodchikov and V.P. Slobodchikova

Institute of Applied Mechanics, USSR

Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1133-1137 (10/1979).

Trans. From: Zurnal Tekhnicheskoi Fiziki 49, 1373-1378 (July 1979).
The author presents a theoretical explanation for the Chare effect (the electrical implosion of conducting liners for magnetic field compression). The diffusion of the field into the liner and subsequent implosion are considered on quantitative basis. 9 Refs.

Primary Keywords: Flux Compression; Electrical Liner Implosion; Theory

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6902
(BREAKDOWN STUDIES)
(Gas, E-beam)**

PULSE DISCHARGES IN GASES UNDER CONDITIONS OF STRONG IONIZATION BY ELECTRONS

Yu.I. Bychkov, Yu.D. Korolev and G.A. Mesyats

Academy of Sciences of the USSR, Tomsk, USSR

Soviet Physics-Uspokhi, Vol. 21, No. 11, pp 944-958 (11/1978).

Trans. From: Uspokhi Fizicheskikh Nauk 126, 451-477 (November 1978).

A review is given of investigations of pulsed high-pressure volume discharges excited by fast electron beams. The following topics are discussed: classification of discharge methods for calculating the current-voltage characteristics, analysis of the optimal ways of depositing energy in the gas in the volume stage of the discharge; discharge instability mechanisms and the corresponding experimental observations; applications of discharges. The results are given of calculations of the electric field in the cathode and anode regions, and also in the discharge column in the case of the spatially inhomogeneous ionization of the gap. It is shown that a stable volume flow of the current in molecular gases in which the specific deposited energy is $0.1-1 \text{ J/cm}^3$ may be attained in a self-sustaining discharge and in a discharge with ionization multiplication. In both cases a spark channel appears in two stages: formation of spark-initiating centers in the form of plasma regions with a higher density near the electrodes is followed by growth of the spark channel from such initiating centers. In some cases the spark channel is formed by a series of successive individual discharges. Models of discharges in mixtures of rare gases with halogen-containing compounds, when electrons are lost mainly by capture by complex molecules, are considered separately. Applications of volume discharges in laser pumping, switching of pulsed currents, plasma chemistry, etc. are described. 106 Refs.

Primary Keywords: Gas Breakdown; Review; Volume Discharge; E-beam Excitation; Spark Channel; Discharge Classification; Initiating Centers

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6910
(ELECTROMAGNETIC FIELD GENERATION)**

(Magnetic)

THEORY OF THE CHARE EFFECT

H.G. Letai

Illinois Institute of Technology, Chicago, IL

Annals Of Physics, Vol. 42, No. 2, pp 352-353 (06/1967).

The author presents a theoretical explanation for the Chare effect (the electrical implosion of conducting liners for magnetic field compression). The diffusion of the field into the liner and subsequent implosion are considered on quantitative basis. 9 Refs.

Primary Keywords: Flux Compression; Electrical Liner Implosion; Theory

COPYRIGHT: 1957 ACADEMIC PRESS

**6911
(BREAKDOWN STUDIES)**

(Vacuum, Electrical)

THEORY OF THE VACUUM ARC

V.A. Nemchinskii

All-Union Institute, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 24, No. 7, pp 764-767 (07/1979).

Trans. From: Zurnal Tekhnicheskoi Fiziki 49, 1373-1378 (July 1979).
A model is proposed for the cathode region of a vacuum arc. The model is closed; the calculations only require a knowledge of the arc current and the properties of the cathode material. Specific calculations are carried out for a copper cathode. The calculated values of the voltage drop across the arc, the heat transferred to the cathode, the current density, and the current per spot are all in agreement with experimental data. 13 Refs.

Primary Keywords: Cathode Region; Vacuum Arc; Current Density; Cathode Potential Drop; Theory; Modeling

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6914
(BREAKDOWN STUDIES)**

(Gas, E-beam)

VOLTAGE-CURRENT CHARACTERISTIC OF GAS DISCHARGE WITH EXTERNAL IONIZATION

E.V. Chekhunov

Moscow, USSR

Journal Of Applied Mechanics And Technical Physics, Vol. 20, No. 4, pp 403-406 (08/1979).

Trans. From: Zurnal Prikladnoi Mekhaniki I Tekhnicheskoi Fiziki 4, 16-19 (July-August 1979).

Steady-state solutions of the discharge equations were obtained elsewhere for a range of values of the external ionization source strength Q , discharge current j , and voltage U such that there was no impact ionization in the positive column, and the voltage was below the breakdown value. The present paper treats a broader range of variation of Q , j , and U . In particular, currents are considered for which impact ionization in the positive column is important, and the voltage is above the breakdown value. 4 Refs.

Primary Keywords: Gas Breakdown; External Ionization Source; Self-sustaining Discharge; Theory; Transient Solution

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

**6916
(PARTICLE BEAMS; REVIEWS AND CONFERENCES)**

(Reviews; Conferences)

ALL-UNION CONFERENCE ON THE APPLICATION OF CHARGED-PARTICLE ACCELERATORS IN THE NATIONAL ECONOMY

O.A. Gusev (Ed.)

Soviet Atomic Energy, Vol. 40, No. 3, pp 334-335 (03/1976).

Trans. From: Atomnaya Energiya 40, 271-274 (March 1976).
The 2nd All-Union Conference on the Application of Charged-Particle Accelerators in the National Economy was held on October 1-3, 1975 in Leningrad. Specialists from 53 organizations and companies of the Soviet Union participated in the conference, representing the Academy of Sciences of the Soviet Union, the State Committee for Nuclear Energy Research, the chemical, petrochemical, electronic, textile, radio and electrotechnical, timber and tree cultivation, power engineering industries, the Ministries of Public Health and Higher Education. Specialists from Poland, the German Democratic Republic, Czechoslovakia, and Hungary also participated.

More than 80 papers were heard on the problems of the development, construction and operation of different types of accelerators, and also their application in radiation chemistry, for industrial defectoscopy and activation analysis, for the sterilization of manufactured goods, the prevention of contamination of the environment, and radiation therapy. 0 Refs.
Primary Keywords: Charged-particle Accelerators; Development Practical Application; Construction And Operation; Radiation Chemistry; Industrial Defectoscopy; Activation Analysis; Radiation Therapy

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

6917
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)

APPROXIMATE THEORY FOR AMPLIFICATION OF MAGNETIC FIELDS
N.N. Kalitkin and L.S. Isareva
Institute Of Applied Mathematics, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 8, pp 1050-1054
(02/1970).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1397-1404 (August 1969)
The compression of a magnetic field by a moving shell of finite conductivity which is assumed to be thin, the process of compression is investigated. The shell material is assumed to be an incompressible fluid (which is justified in fields up to 3-4 Moe), and the diffusion of the magnetic field into the shell is calculated from the skin depth. Under these approximations the mathematical problem reduces to the solution of a system of three ordinary differential equations. Accurate solutions can be obtained in a number of cases. Numerical data are presented which agree quite well with experiment. 13 Refs.

Primary Keywords: Magnetic Field Compression; Moving Shell; Magnetic Flux Leakage; Skin Depth; Theory

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6918
(POWER TRANSMISSION)
(Transmission Lines)

CAPACITOR DISCHARGE INTO A LOAD CONSISTING OF TWO PARALLEL LEADS WITH SKIN EFFECT

V.T. Yurchenko
Nuclear Physics Institute, Academy of Sciences of the USSR,

Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 9, pp 1180-1184
(03/1973).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1865-1873 (September 1973)

Allowance is made for the skin effect in an analysis of the discharge of a capacitor into a load consisting of two parallel leads. It is assumed that the leads are infinitely thick and that edge effects can be neglected. The exact solution is used to calculate several characteristics of the discharge process which are useful in practice. A method is indicated for solving the problem for other simple geometries. 7 Refs.

Primary Keywords: Parallel Wire Transmission Line; Capacitor Discharge; Skin Effect; Field Gradient

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6919
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
COMPUTER CALCULATION OF QUASISTATIONARY PULSED MAGNETIC FIELDS

V.I. Yurchenko
Institute Of Nuclear Physics, Academy of Sciences of the USSR,

Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 8, pp 1025-1030
(02/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1641-1649 (August 1974)

A procedure for calculating two-dimensional magnetic fields (plane-parallel or with rotational symmetry) is described. The skin effect is taken into account. The procedure is based on the replacement of a differential equation by a system of difference equations relating the values of the vector potential at different points of a rectangular grid at two different times. Two iteration methods, a longitudinal-transverse method and an upper-relaxation method, are used to solve the difference equations. The calculation procedure is illustrated for the case of a pulsed magnet. The calculation is carried out for an impulse function excitation. In this form, the results can be used in a simple manner to determine the field for any functional dependence of the excitation on time. The procedure for calculating the field is described for the case in which a capacitor is series into a magnetic circuit length. 12 Refs.

Primary Keywords: Magnetic Field Calculations; 2-d Field Calculation;

Skin Effect; Pulsed Magnet Coil

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6920
(BREAKDOWN STUDIES)

(Exploding Wires)

CONDITIONS FOR THE CURRENT PAUSE IN EXPLODING WIRES

E.I. Azarenovich, Yu.A. Potov and V.S. Sedov

Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 111-112 (07/1975)

By exploding wires in an LC circuit we have determined generalized variables that describe the vaporization stage: $\lambda_{\text{cr}} = 1/\nu \text{sub cr}$ divided by $n \text{d}^2/2\pi S_0 T_{\text{LLC}}(L/C)$, $n \nu = S_0 T_{\text{LLC}}(L/C)$, where n , d , and L are the number, diameter, and length of the wires; C and I are the capacitance and inductance of the circuit. By using generalized variables, it is possible to exploit experiments with copper wires to determine the dependence of the current on the initial conditions: $\lambda_{\text{cr}} = 1/3.553 (1 - \epsilon \text{sub cr})^{1/2} (n \nu)^{1/2} S_0^2 L^2 / (n d^2 \nu^2 L^2)$, where $\lambda_{\text{cr}} = 1/l$ divided by $n d^2/2\pi S_0 T_{\text{LLC}}(L/C)$, l is the minimum length for which a current pause is observed. The expression holds over a wide range of initial conditions. 3 Refs.

Primary Keywords: Current Pause; Exploding-Wire Devices; Critical Conductor Length; Wire Characteristics; Vaporization Stage

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6921
(SWITCHES, CLOSING)

(Thytronics)

CONTROLLED MEGAVOLT GAS-FILLED DISCHARGER

V.M. Evdokimovich, B. Evlampiev, G.S. Korshunov, V.A. Nikoleev, Yu.F. Sviridov and V.V. Khmyrov
Tomsk Polytechnic Institute, Tomsk, USSR
Instrumentation And Experimental Techniques, Vol. 23, No. 5, pp 1190-1192
(10/1980).

Trans. From: Priroda i Tekhnika Eksperimenta 5, 127-128 (September-October 1980)

A megavolt gas-filled thyatron-type discharger is described with a sectional gas-discharge chamber, having a delay or spark ignition of $t \text{sub cr} = 0.1$ microseconds together with a more than threshold range of operating voltage. A dielectric bushing is used in the ignition assembly of the thyatron projecting above the plane of the base electrode. 3 Refs.

Primary Keywords: Megavolt Gas-filled Discharger; Thyatron; 10-Torr 1 Microsecond Spark Ignition Delay; Dielectric Bushing; Voltage Range and Voltage Anode Current Range; Thyatron Ignition Assembly; Sectional Discharge Chamber

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

6922
(POWER CONDITIONING)
(Saturation Reactors)

DEFORATION OF INTENSE WAVES TRAVERSING A FERRITE DISCONTINUITY IN A TRANSMISSION LINE

G.A. Mesyats and R.B. Bakht

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics-Technical Physics, Vol. 10, No. 5, pp 685-689 (11/1965).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 889-896 (May 1965).
It is shown that if a wave passes through a lumped ferrite discontinuity placed in series or in shunt with a transmission line, it is possible to narrow the width of the leading edge and to reduce the wavelength to 0.9 sec. 7 Refs.

Primary Keywords: Transmission Line; Lumped Ferrite Discontinuity; Electromagnetic Shock Waves; 10-9 sec Pulse Front; Narrowed Pulse Front; Homogeneous Transmission Lines; Flux-reversal Equation

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6923
(BREAKDOWN STUDIES)

(Gas; Electrical)

DELAY IN PULSED BREAKDOWN OF WEAKLY ILLUMINATED GAPS

V.A. Avrutskii

Moscow Institute Of Power Engineering, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 20, No. 10, pp 1375-1380
(10/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 2194-2202 (October 1975).
A theoretical examination is made of the processes taking place in the volume of the gas and at the cathode surface before a discharge develops and the effect on primary electrons, i.e., the statistical delay of breakdown of weakly illuminated gaps occurring at considerable distances from the cathode (of the order of 105 V/m). The theoretical investigation is conducted on the assumption of the ion-electron mechanism of primary electron generation. Expressions are obtained which connect the statistical delay time with the field, the gas pressure, the dimensions of the gap, the power of ionizing radiation of the background of natural radiation, and with factors characteristic of the material and the state of the cathode surface. The expressions obtained are in good qualitative and quantitative agreement with experimental data in the literature. 24 Refs.

Primary Keywords: Gas Breakdown; Ionizing Radiation; Prebreakdown Phenomena; Primary Electrons; High Overvoltage

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6926
(SWITCHES, CLOSING)

(Gas Gaps; Recovery)

DISCHARGER WITH HIGH PULSE REPETITION FREQUENCY

D.D. Mel'nyuk and V.S. Muzhevov

Instruments And Experimental Techniques, Vol. 23, No. 4, pp 900-901
(08/1980).

Trans. From: Priroda i Tekhnika Eksperimenta 4, 89-90 (July-August 1980).

Construction is described of a discharger capable of operating at a repetition frequency of 4 kHz and duration of 0.1-1 microsecond at an operating voltage of 20 kV and current amplitude of 1-10 kA. The discharger operates with a current of nitrogen blown through it with a cycle of duration approximately 0.5 sec. 3 Refs.

Primary Keywords: Gas Spark Gap; Electrical Trigger; Nitrogen Gas; High Flow Rate; 40 kV Operating Voltage; 10 kA Current. Reprinted; 4 kHz Repetition Rate

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

6927
(BREAKDOWN STUDIES)

(Gas; E-beam)

DYNAMIC ATMOSPHERIC PRESSURE DISCHARGE EXCITED BY AN ELECTRON BEAM

Yu.I. Bychkov, Yu.D. Korolev, G.A. Mesyats, V.V. Savin and A.P. Khuzeev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 20, No. 11, pp 1502-1504
(11/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 2412-2415 (November 1975).
A study is made of a stationary atmospheric-pressure discharge in a flowing gas; the discharge is excited by a beam of fast electrons. The possibility of utilizing this kind of discharge in a gas laser is investigated. A stable discharge is obtained with dissipated power of 1.5 kW/cm². The current density of the beam of fast electrons is typically 10-50 microamps/cm² and the corresponding discharge current density is 100-300 mA/cm². 6 Refs.

Primary Keywords: E-beam Excited Discharge; CO₂/sub 2/ Breakdown; Atmospheric Pressure; Flowing Gas; Stable Discharge

Secondary Keywords: Gas Laser Pumping
COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6928

(BREAKDOWN STUDIES, SWITCHES, CLOSING)

(Electrodes; Gas Gaps; Materials)

EFFECT OF THE MEDIUM ON THE ELECTRICAL EROSION OF ELECTRODES AT HIGH CURRENTS

G.S. Belkin and V.Ye. Kiselev

Moscow Polytechnic Institute, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 23, No. 1, pp 24-27 (01/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 42-48 (January 1978).

Devices with high pulsed currents are widely used in the laboratory and in industry. High currents through the working and switching gaps cause electrode wear, so that the electrode shape is changed and the insulation and the medium become contaminated. The quantitative characteristics of the electrode wear are reported by many authors but the effect of the medium on erosion is not well understood. Our purpose in the present work is to compare the erosion processes in discharges in various media and to determine the characteristics of the erosion in dense and low-density media. Electrical erosion due to current pulses with lengths of tens or hundreds of microseconds has much in common with erosion due to 50-Hz currents. We therefore report results for both short pulses and for current pulses at 50 Hz. 10 Refs.

Primary Keywords: Electrode Erosion; Pulsed Current; Power Line Frequency Current; Insulation Contamination; Discharge Parameter Variation; Copper Electrodes; 10 Hz

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

- 6929**
(BREAKDOWN STUDIES)
(Gas; E-beam)
ELECTRIC FIELD DISTRIBUTION IN THE ANODE LAYER OF A NON-SELF-MAINTAINED VOLUMETRIC DISCHARGE SUSTAINED BY A BEAM OF FAST ELECTRONS
Yu.D. Korolev, V.V. Krennev and V.B. Ponomarev
Institute Of Atmospheric Optics, Academy of Sciences of the USSR,
Moscow, USSR
Soviet Physics Journal, Vol. 20, No. 3, pp 406-409 (03/1977).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii 20, 150-152 (March 1977).
- The interest in the study of the electrode layers of non-self-maintained discharges is connected with the fact that the character of the distribution of charged particles in these layers to a considerable extent determines the mechanism of conduction. An additional stimulus to the research arose when it was noted that the formation of spark channels, which lead to the cutoff of the volumetric flow of current, begins in the regions near the electrodes. In the work done earlier the principal attention was paid to the calculation of the characteristics of the cathode layer. The results of analytical and numerical calculations of the anode region of a non-self-maintained discharge are presented in this report. 9 Refs.
- Primary Keywords:** Gas Discharge; Volume Discharge; E-beam Sustained Discharge; Spark Channel; Cathode Layer; Anode Layer
- COPYRIGHT:** 1977 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6930**
(BREAKDOWN STUDIES)
(Explosives)
ELECTRIC STRENGTH OF SCATTERED DETONATION GASES
P.I. Zubkov, L.A. Luk'yanchikov and Yu.V. Ryabinin
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 19, No. 1, pp 109-112 (02/1976).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 134-138 (January-February 1976).
- One of the most important characteristics in schemes used for the formation of inter-pulse pulses in a given shape by means of condensed explosives is the current density that can be obtained in the detonation wave. Whenever the electrical conductivity is determined directly by the detonation process, the maximal current density depends on the maximal electric field strength at which breakdown of the detonation gases no longer occurs, i.e., on their electric strength. This magnitude also determines the characteristics of safety detonators operating at high inverse voltages. Prediction of the parameters of detonators maintained at a high voltage requires knowledge of the electric strength of the detonation gases as a function of pressure. This is because the gaps formed as current is switched off are found under conditions characterized by nonstationary expanding explosion gases, as a result of which their electric strength is not dependent as a function of pressure. The required parameters of safety detonators can be obtained from a joint solution of the hydrodynamic scattering problem for detonation gases and the motion of current-carrying elements and of electrical circuit equations if the dependence of electric strength on pressure is known. In the current work, fundamental results are set forth from an experimental study of the electric strength of expanding detonation gases from bulk density PETN and Hexogen charges. 6 Refs.
- Primary Keywords:** Electrical Pulse Generator; Condensed Explosives; Detonation Wave; Detonation Product Breakdown; Maximum Current Density; PETN Explosive
- COPYRIGHT:** 1976 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6931**
(BREAKDOWN STUDIES; SWITCHES, CLOSING; SWITCHES, OPENING)
(Gas; E-beam; Gas Gaps; E-beam; Gas Gaps; E-beam)
ELECTRIC-FIELD INSTABILITIES OF A VOLUME GAS DISCHARGE EXCITED BY AN ELECTRON BEAM
G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Technical Physics Letters, Vol. 7, pp 292-293 (07/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 660-664 (July 1975).
- A volume discharge excited by an electron beam in a gas at atmospheric pressure and higher is used in CO_{2}/Ar lasers, in gas-based switches, in plasmotrons, etc. The principal feature of this discharge is the transition from the volume mode into a channel mode. It has been proposed that this transition is caused by instabilities that arise in the plasma. We believe that under certain conditions this transition can also be due to the spatial inhomogeneity of the electric field. 11 Refs.
- Primary Keywords:** Volume Gas Discharge; Spatial Inhomogeneity; Cathode Instability; Detonation Instability; Injection Instability
- COPYRIGHT:** 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 6932**
(BREAKDOWN STUDIES)
(Explosives)
ELECTRICAL CONDUCTIVITY IN THE DETONATION ZONE OF CONDENSED EXPLOSIVES
P.I. Zubkov, L.A. Luk'yanchikov and B.S. Novoselov
Novosibirsk, USSR
Combustion, Explosion, And Shockwaves, Vol. 7, No. 2, pp 253-256 (06/1971).
Trans. From: Fizika Goreniya i Vzryva 7, 295-299 (April-June 1971).
- It is known that a zone of relatively high electrical conductivity occurs upon detonation of condensed explosives. Thermal ionization, chemical reactions, and high densities that are developed in the detonation wave can be the cause of formation of high electrical conductivity. It is not possible to determine separately the effect of each of these phenomena on the basis of what is known, since for this purpose it is necessary to know the character of the carriers and the distribution of conductivity in the region of the detonation wave. Here we present experimental data on a determination of the distribution of conductivity in the detonation zone. The measurements were taken during detonation of powdered PETN with a density of 1.1 g/cm³ and RDX with a density of 1.2 g/cm³. 5 Refs.
- Primary Keywords:** Explosive Detonation Product; Conductivity Measurement; Conductivity Distribution; Detonation Wave; Powdered PETN Explosive
- COPYRIGHT:** 1973 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6933**
(BREAKDOWN STUDIES)
(Solid; Electrical)
ELECTRICAL DISCHARGE IN PENTAERYTHRITOL TETРАNITRATE POWDER
P.I. Zubkov and L.A. Luk'yanchikov
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 11, No. 4, pp 637-640 (08/1970).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 128-131 (July-August 1970).
- The article presents some results of oscillographic investigations of an electric discharge in pentaerythritol tetranitrate (PETN) powder of density (0.5-1.2) g/cm³. A hydrodynamic model of the development of the current-conducting channel was used; estimates of the rate of its development and values of its radius and of the transformation products of PETN have a conductivity not above 766 sec. 5 Refs.
- Primary Keywords:** PETN; Oscillography; Investigations; 5-1.2 g/cm³; Powder Density; 766 Sec Transformation Product Conductivity; Discharge Plasma Conductivity; Current Cutoff
- COPYRIGHT:** 1973 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6934**
(BREAKDOWN STUDIES)
(Explosives)
ELECTRICAL STABILITY OF DETONATION PRODUCTS OF CONDENSED EXPLOSIVES
P.I. Zubkov, L.A. Luk'yanchikov and Yu.V. Ryabinin
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 19, No. 3, pp 315-318 (06/1978).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 3, 44-47 (May-June 1978).
- The development of the various areas of experimental physics and technology requires the creation of high-power, high-speed switching devices. The most promising from the point of view of obtaining the necessary switching parameters are commutators based on the use of condensed explosives. A study of the electrical properties of the detonation products of explosives, filling the gaps in the electrical chain and defining the switching characteristics of circuit breakers, has been stimulated by the creation of the optimum design of an explosive switch. The electrical stability of the detonation products of a charge of PETN (containing 40% nitrocellulose) located between the ends of cylindrical tungsten electrodes has previously investigated. It is shown that, with the experimental accuracy, the stability of the gap up to a specified stage of expansion of the detonation products is constant (FF100-120 kV/cm), later, the stability falls rapidly. In the present paper the principal experimental results of an investigation of the electrical stability of the exploding detonation products of condensed explosives under the condition that their density is considerably lower than the density in the detonation wave and also of the static stability of the products in the pressure range 1-1 atm are given. 3 Refs.
- Primary Keywords:** Explosive Detonation Products; Electrical Stability; High-power Switch; Gas Density Dependence
- COPYRIGHT:** 1978 PLENUM PRESS, REPRINTED WITH PERMISSION
- 6935**
(BREAKDOWN STUDIES)
(Gas; E-beam)
ENERGY INPUT IN ELECTRICAL IONIZATION LASERS
Yu.I. Zychkov, Yu.D. Korolev, Yu.A. Kurbatov and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 4, pp 499-502 (10/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 791-796 (April 1974).
- The development of a volume discharge excited by a beam of fast electrons is studied at pressures $P \geq 1$ atm. The current characteristics are calculated allowing for the parameters of the discharge circuit and the energy input to the gas is analyzed. For $P = 1$ atm the specific energy introduced into a mixture of $\text{N}_2/\text{Ar} 2/1$ and $\text{CO}_2/2$ is kJ/cm^3 approximately 1 J/cm^3 . These values are achieved at a current density in the electron beam of approximately $10^{-10} \text{ A}/\text{sq. cm}$ and a mean lifetime τ_{beam} of approximately 4×10^{-8} sec. It is shown that maintenance of the discharge by ionization processes permits a substantial reduction in the beam current while maintaining acceptable energy characteristics and sparkless operation. For example, $\text{H}_2/\text{Ar} 1/1$ with $\text{j}_{beam} \approx 0.1 \text{ A}/\text{sq. cm}$ and $\tau_{beam} \approx 2 \times 10^{-8}$ sec. 10 Refs.
- Primary Keywords:** E-beam Excited Discharge; Volume Discharge; Circuit Parameter Variation; Energy Input; Beam Current Reduction
- COPYRIGHT:** 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 6936**
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas; Electrical; Electrodes)
EXPLOSIVE PROCESSES AT THE CATHODE OF A GAS DISCHARGE
G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Technical Physics Letters, Vol. 1, No. 10, pp 385-386 (10/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 885-888 (October 1975).
- Numerous experimental investigations of the vacuum discharge have demonstrated the fundamental role played by explosive emission of electrons in the initiation of the discharge and maintenance of the cathode spot. The electric field in the region of cathode breakdown is approximately 100 kV/cm. The field at the cathode becomes stronger because of microscopic inhomogeneities. To observe explosive processes at the cathode in a nanosecond discharge in a gas we have investigated the microstructure of the cathode. It is known from an investigation of the vacuum discharge that the explosive emission leads to the formation of microscopic craters on the cathode. Microscopic craters have been observed in a discharge in atmosphere. 10 Refs.
- Primary Keywords:** Gas Discharge; Explosive Electron Emission; Cathode Spot; Nanosecond Discharges; Microscopic Craters; Copper Electrodes
- COPYRIGHT:** 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6937
(PULSE GENERATORS)
(Flux Compression)

EXPLOSIVELY-DRIVEN MAGNETIC GENERATOR WITH FAST MEGAGAUSS FIELD
L.V. Bebarina, D.P. Sobolev and A.E. Voitenko,
Institute Of Nuclear Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR

Astronautica ACTA, Vol. 15, pp 292-299 (01/1970).

The authors describe a magnetic flux compression generator utilizing a flat geometry. The generator is designed so that the compression cavity forms its own closing switch. It is hypothesized that skin-depth evaporation limits magnetic field intensity. Fields of 1.5 MG and current rise rates of 7E11 A/sec are reported. 5 Refs.

Primary Keywords: Flux Compression Generator; Plane Geometry; 7E11

Asec Current Rise Rate; Self-closing Switch;

Aluminum Plates; Copper Plates; Skin-depth Plate

Evaporation.

COPYRIGHT: 1970 PERGAMON PRESS, INC.

6938

(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)

(Magnetic; Flux Compression)

FLUX LOSS IN THE PRODUCTION OF ULTRASTRONG FIELDS BY RAPID COMPRESSION

OF CONDUCTING SHELLS

V.I. Yurchenko

Institute Of Nuclear Physics, Academy of Sciences of the USSR,

Novosibirsk, USSR

Soviet Physics-Technical Physics, Vol. 19, No. 8, pp 1031-1033

(02/1974).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 44, 1650-1655 (August 1974). The flux-loss problem is written as a system of two equations under the assumption that the shell compressing the plasma is solid and that certain parameters, which are functions of the shell geometry alone, are specified. These equations are solved for certain particular cases of compression. Despite the loss through the sliding contact, the field amplification is much higher in systems in which the shell contour decreases in length during the compression. 7 Refs.

Primary Keywords: Flux Compression; Metallic Liner Implosion; Driver

Geometry Considerations; Theory; Numerical

Calculation.

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

6939

(BREAKDOWN STUDIES)

(Gas; E-beam)

FORMATION OF A SPARK CHANNEL IN A BULK DISCHARGE INITIATED BY A

FAST-ELECTRON BEAM

Yu.D. Korolev and A.P. Khuzeev

Institute Of Atmospheric Optics, Academy of Sciences of the USSR,

Moscow, USSR

High Temperature, Vol. 13, No. 4, pp 779-780 (08/1975).

Trans. From: Teplifizika Vysokikh Temperatur 13, 861-862 (July-August

1975).

High-pressure bulk discharges excited by an external ionization source, e.g., a beam of accelerated electrons, have been used to pump gas lasers and to switch powerful pulsed currents. In both cases, it is important to prevent breakdown of the spark channel. Breakdown delay time at different gas pressures and in different mixtures has been measured. In the present paper the dynamics of channel formation are investigated directly by observing the light patterns of discharge development. 5 Refs.

Primary Keywords: Gas Discharge; E-beam Sustained Discharge; Volume

Discharge; Spark Channel Formation; Photographic

Diagnostic.

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

6942

(BREAKDOWN STUDIES)

(Gas; Electrical)

GROWTH OF A NANOSECOND PULSED DISCHARGE IN A GAS WITH ONE-ELECTRON INITIATION

V.V. Kramnev and G.A. Mesyats

Academy of Sciences of the USSR, Tomsk, USSR

Academy of Applied Mechanics And Technical Physics, Vol. 12, No. 1, pp

33-37 (02/1971).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1,

40-45 (January-February 1971).

Pulse breakdown on gases of millimeter order at substantial overvoltages is explained in terms of a discharge mechanism involving photodielectric emission from the cathode followed by collisional multiplication in the gas to give avalanches. The mechanism is used to deduce a theoretical equation for the time of discharge buildup in one-electron mutation, which is compared with experiment. 17 Refs.

Primary Keywords: Nanosecond Pulsed Discharge; Discharge Buildup Time;

Avalanche Theory; Streamer Mechanism; One-electron

Initiation.

COPYRIGHT: 1973 PLENUM PRESS, REPRINTED WITH PERMISSION

6946

(SWITCHES, CLOSING)

(Liquid Gaps; Optical)

LASER IGNITION OF THE WATER DISCHARGER FOR THE TWIN PULSE-FORMING LINE

OF AN ELECTRON ACCELERATOR

B.A. Demidov, M.V. Ivkin and V.A. Petrov

Instruments And Experimental Techniques, Vol. 23, No. 4, pp 904-906

(08/1980).

Trans. From: Pribory i Tekhnika Eksperimenta 4, 93-95 (July-August

1980).

In experiments on the laser ignition of a water discharger for the twin pulse-forming line of the Keldysh precision pulse electron accelerator using a 300-MHz laser pulse, we have been successful in triggering a water discharger with an average time spread of not more than $\Delta t = 8$ nsec at a voltage between electrodes of 600 kV. Laser switching reduces the rise time of the pulse being formed by 10-15% and reduces the energy loss in the discharger by factor of 1.5. 6 Refs.

Primary Keywords: Water Spark Gap; Laser Triggering; 600 kV Operating

Voltage; 16 ns Jitter; 10% Rise Time Reduction

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

6947

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

MECHANISM FOR NANOSECOND VACUUM PULSED DISCHARGE

L.P. Babich and M.D. Tereshko
Radiophysics And Quantum Electronics, Vol. 23, No. 11, pp 914-920
(11/1988).

Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika 23,

1365-1372 (November 1980).

Spectral analysis is used to demonstrate the absence of a near-cathode plasma flame for nanosecond electric discharges in a vacuum. Arguments are presented in support of a thermomeission mechanism for the discharge current. The place and role of the desorption mechanism and breakdown of insulating films in the development of the discharges are discussed. 20 Refs.

Primary Keywords: Vacuum Breakdown; Cathode Flare; Thermomeission; Insulating Film; Desorption

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

6948

(BREAKDOWN STUDIES)

(Liquid, Electrical)

MECHANISM OF THE PULSED ELECTRICAL BREAKDOWN OF WATER

E.V. Yanushin, I.T. Ovchinnikov and Yu.N. Vershinin
Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR

Soviet Physics Doklady, Vol. 19, No. 2, pp 95-96 (08/1974).

Trans. From: Doklady Akademii Nauk SSSR 213, 1303-1307 (February 1974).

The main factors governing the nature of liquid dielectric breakdown are the conductivity and the duration of the effective voltage. Depending on the combination of these factors, it is assumed that breakdown is accomplished either by a charge or an ionization mechanism. The latter is considered responsible for the breakdown of pure liquids by pulses of $<10^{-6}$ sec duration. However, using ionization mechanisms to explain experimental results encounters significant difficulties and needs additional assumptions. The following mechanism for pulsed breakdown of water is proposed. The action of voltage on the discharge gap is accompanied by the origin of a positive surface charge on the anode, formed by electron vacancies. Polarization and displacement of the nearest water molecules, complicating the passage of electrons from these molecules to the anode, occurs in the field of these vacancies. In turn, ionization of the water molecules results in the formation of hydroxide ions near the anode. Further charge transfer to the cathode occurs by ion migration, with the sole difference that the rate of this process is determined to a great extent by the proton skipping time, since the anode voltage is put out by already favorably oriented in a strong electrical field. 7 Refs.

Primary Keywords: Water Breakdown; Pulsed Breakdown; Proton Mobility; Anode Surface Charge; Positive Charge Transfer

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

6949

(INSULATION, MATERIAL; BREAKDOWN STUDIES; POWER CONDITIONING)

(Liquid; Liquid, Electrical; Systems)

MEGAVOLT ENERGY-CONCENTRATING DEVICE

E.A. Abramyan, V.A. Kornilov, V.N. Lagunov, A.G. Ponomarenko and R.I. Soloukhin

Institute Of Theoretical And Applied Mechanics, Siberian Branch,

Academy Of Sciences Of The USSR, Novosibirsk, USSR

Soviet Physics-Techical Physics, Vol. 16, No. 11, pp 983-985 (05/1972).

Trans. From: Doklady Akademii Nauk SSSR 201, 56-59 (November 1971).

In research related to pulsed energy sources, one encounters several problems requiring beams of relativistic electrons with power $10^{12} - 10^{14}$ W for heating plasmas, for the coherent acceleration of ions, and for the generation of giant flashes of x-ray radiation or uhf radiation. Powers of this order of magnitude are usually obtained in the following fashion: electric energy with the density ρ_0/ρ' is initially stored in a large volume and then transferred, within a short time interval, into an area with increased energy density, where $\rho > \rho_0/\rho'$. Following a suggestion of G.I. Budker, we discuss in this present article the possibility of using especially pulsed additional water as a dielectric in energy-density-increasing devices operated at voltages in excess of 10⁶ V. Due to the high dielectric constant of water, $\epsilon = 80$, and the relatively high breakdown strength $E_{BD}^2 = 10^9$ V/cm², it is possible to obtain specific powers p approximately 3E9 W at the load in the case of an optimized system for increasing the energy density. We mention for comparison that the use of other dielectric materials (transformer oil or polyethylene) in similar devices decreases p by approximately two orders of magnitude. Water has still another advantage over other dielectrics: the electric breakdown strength of water is restored after uncontrollable discharges. 7 Refs.

Primary Keywords: Pressurized Water Dielectric; Tesla Transformer; Water Transmission Line; Multimegavolt Output; Water Breakdown Tests

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

6951

(BREAKDOWN STUDIES)

(Gas, Electrical)

NANOSECOND FORMATION TIME OF DISCHARGES IN SHORT AIR GAPS

G.A. Melnikov, Yu.I. Bychkov and A.I. Ishol'dskii

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics-Techical Physics, Vol. 13, No. 8, pp 1051-1055

(02/1969).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1281-1287 (August 1968). The formation time of a discharge in air gaps about one millimeter long, where the rise time of the breakdown pulse is 2.5E-10 sec, was investigated. It is shown that when breakdown is initiated by single electrons the time is much larger than in the case of multi-electron initiation. This is due to self-arrest of the avalanches by the ion space-charge field. In the case of multi-electron initiation the increase in current during time is due to the development of a large number of avalanches from the initiating electrons. 15 Refs.

Primary Keywords: Short Time Lag; Air Gaps; 1 mm Gap; Single-electron Initiation; Ion Space Charge

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

6952
(PARTICLE BEAMS; ELECTRON)
(Generation)

ON POSSIBILITIES OF TRANSFORMER TYPE ACCELERATORS
E.A. Abramyan
Institute Of Nuclear Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Nuclear Instruments And Methods, Vol. 59, No. 1, pp 22-28 (02/1968).
The MeV direct transformer type accelerators are reviewed. Units generating electron beams of mean power of tens of kW and machines with pulse power of 1E8-1E9 W and frequency of several tens of cps are described. The efficiency of the first type accelerators is 90-95% that of the second type is up to 80-90%. The main parameters of several accelerators are given. Possibilities of increasing the highest energies of such driven intensive proton beam accelerators and other problems are discussed.
Primary Keywords: E-beam; Transformer Accelerator; Re-rated; High Efficiency; Tesla Transformer
COPYRIGHT: 1968 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

6953
(BREAKDOWN STUDIES)
(Liquid; Electrical)

OPTICAL STUDY OF NANOSECOND PREBREAKDOWN PHENOMENA IN WATER
E.V. Yanshin (1), I.T. Ovchinnikov (1) and Yu.N. Vershinin (2)
(1) Institute Of Automation And Electrometry, Academy of Sciences of the USSR, Novosibirsk, USSR
(2) Scientific-Research Institute Of Energetics, Novosibirsk
Soviet Physics-Technical Physics, Vol. 18, No. 10, pp 1303-1306 (04/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 2067-2074 (October 1973).
An experimental study has been made of the characteristic emission and shadow patterns of the initial stage of a discharge in a highly inhomogeneous field with the point electrode held at positive and negative polarities. A "quasi-hole" mechanism for the electrical conductivity of water in an intense electric field is proposed to explain the experimental results. A non-ionization criterion is formulated for the pulsed breakdown of water. 12 Refs.
Primary Keywords: Experiment; Inhomogeneous Field; "Quasi-hole"; Non-ionization
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6955
(PULSE GENERATORS)
(Pulse Forming Lines)

PUMPING OSCILLATOR FOR LASERS HAVING TRANSVERSE EXCITATION
V.F. Losav, V.F. Teresenko and A.I. Fedorov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 19, No. 5, pp 1493-1494 (10/1976).
Trans. From: Pribory i Tekhnika Eksperimenta 5, 213-214 (September-October 1976).
An oscillator is described in which strip lines based on ceramic having a high permittivity are used. The oscillator is distinguished by its compactness, and allows synchronized radiation pulses to be obtained in several directions. 5 Refs.
Primary Keywords: Pumping Oscillator; High Permittivity Strip Lines; Synchronized Radiation Pulses; Traveling Excitation Wave; Minimum Inductance
Secondary Keywords: Gas Laser Pumping
COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

6956
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas; E-beam; Gas Gaps; E-beam)

SOME CHARACTERISTICS OF A SPARK DISCHARGE INITIATED BY AN ELECTRON BEAM
V.G. Emelyanov, B.M. Koval'chuk and Yu.F. Potalitsyn
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 17, No. 5, pp 720-721 (05/1974).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 17, 136-137 (May 1974).

It has been shown that when a beam of fast electrons is injected into a gas-filled discharge gap, different types of volume or spark discharges can occur. The present paper describes the characteristics of a 250 kV spark discharge initiated by an electron beam. 6 Refs.
Primary Keywords: Fast Electron Beam; Gas-filled Discharge Gap; 250 kV Spark Discharge; 1-20 mm Electrode Gap; 180 keV Maximum Electron Energy; 1-100 A Current Amplitude; 5E-9 sec Current Pulse Length
COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

6957
(POWER CONDITIONING; POWER CONDITIONING;
(Peaking Gaps; Saturable Reactors)

SPARK PULSE PEAKING DEVICES WITH LOW SENSITIVITY TO PULSE HEIGHT
G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 3, pp 400-402 (09/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 516-518 (March 1965).
Peaking circuits are devices serving to narrow the waveform of a pulse down to 1E-9 - 1E-10 sec leaving the amplitude of the pulse unaffected. Spark-triggered peaking circuits and systems in which electromagnetic shock waves are generated are reported to in the case of high voltage pulses. The basic characteristics of peaking circuits are the duration of the pulse front at the output, t_{peak}/t_{input} , the peaking efficiency $k_{peak}/k_{input} = t_{peak}/t_{input}$ divided by t_{peak}/t_{input} (where t_{peak}/t_{input} is the duration of the front of the input pulse), the peak pulse amplitude U_{peak}/U_{input} , the amplitude ratio $k_{peak}/k_{input} = U_{peak}/U_{input}$ divided by U_{peak}/U_{input} and the peaking time τ_{peak}/τ_{input} from the instant the pulse arrives at the peaking circuit till the appearance of the transformed pulse such that $t_{peak}/t_{input} \approx t_{peak}/\tau_{input}$. The values of t_{peak}/t_{input} and of k_{peak}/k_{input} attain 1E-9 sec and about 1E-1 sec, respectively, for both types of peaking circuits. 6 Refs.
Primary Keywords: Spark Gap; Ferroite; Pulse Amplitude Dependence; Size Considerations; Pulse Shaping Efficiency
COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

6960
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas; Electrical; Gas Gaps; Self)

THE DIFFUSE AND CHANNEL STAGES IN THE OVERVOLTAGE BREAKDOWN OF A GAS GAP
Yu.I. Bychkov, Yu.D. Korolev and V.M. Orlovskii
Institute Of Atmospheric Optics, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Journal, Vol. 14, No. 9, pp 1198-1201 (09/1971).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii Fizika 14, 45-49 (September 1971).

An interrupted discharge has been used to examine the production of light in the breakdown of an overvoltage gas gap in air under conditions of $E/p = 90-110$ V/cm-mm Ha. It is found that there are two types of discharge, the type being dependent on the number of initial electrons: diffuse when there are many electrons and of channel type when there is a single initiating electron. The observed voltage-fall curves for the first type of discharge agree well with theoretical ones derived from the avalanche theory. A study has been made of the dependence of the delay time and switching time on the relative intensity of the illumination used to produce the initial electrons. 10 Refs.

Primary Keywords: Gas Breakdown; Diffuse Breakdown; Spark Channel; Dependence Of Initial Electron Number; Switching Delay
COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

6961
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
A NEW METHOD OF HIGH MAGNETIC FIELD GENERATION AND ITS APPLICATIONS
M. Date
Osaka University, Suita, Osaka, Japan
IEEE Transactions On Magnetics, Vol. MAG-12, No. 6, pp 1024-1029 (11/1976).

A new method of generating high pulsed magnetic fields up to about 1 MWe without destroying coils is described. The magnet consists of multi-layer coils which were designed so as to share the strong Maxwell stress within their total length. A small 4-layer model magnet was tested with the maximum field of 1.07 T and with the pulse width of 0.18 m sec. was obtained without destroying the coil. A three-year project of constructing a high magnetic field laboratory based on the new idea is proceeding in Osaka University. A 1.5 MJ energy source is used to produce up to 1 MWe within a volume of 20 mmD x 20 mm and low temperature experiments will be possible after two years. At present, however, the experiments at liquid helium temperatures are limited up to 0.5 MWe. The submillimeter electron spin resonance experiments under the strong field were done using HCN and H₂Sb 2/0 lasers and the determination of exchange constant between dissimilar spins was done. New terms, H₂Sb 2/2, H₂Sb 2/1 and H₂Sb 3/2 in the spin Hamiltonian are also discussed. Magnetization measurements in metals and compounds are reported. 21 Refs.

Primary Keywords: Magnetic Field Generation; 1 MWe Field; Multiple Shot Coil; Multi-layer Coil; Stress Sharing; Materials Study
COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

6965
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
LIMITATIONS ON MAGNETIC FIELDS OBTAINED BY FLUX-COMPRESION: I
G. Lehrer, J.G. Lichert and J.P. Somon
Lab. Gas Ionizzati, Eureatom-CHEN, Frascati, Italy
Nuclear Fusion, Vol. 4, No. 4, pp 362-379 (12/1964).
The losses of a flux compression device are analyzed with the purpose of applying energy balance to estimate limits on magnetic field generation by flux compression. The two primary loss mechanisms considered are field diffusion and linear heating. 20 Refs.
Primary Keywords: Magnetic Field Generation; Flux Compression; Loss Mechanisms; Field Diffusion; Linear Heating; Field Strength Limitation
COPYRIGHT: 1964 INTERNATIONAL ATOMIC ENERGY AGENCY

6966
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
INTRODUCTION AND USE OF HIGH TRANSIENT MAGNETIC FIELDS. II
H.P. Furth (1), M.A. Levine (2) and R.W. Waniak (3)
(1) University of California, CA
(2) MIT, Bedford, MA 01730
(3) Massachusetts Institute of Technology, Cambridge, MA
The Review Of Scientific Instruments, Vol. 28, No. 11, pp 949-958 (11/1957).
The transient containment of high magnetic energy densities in coils of various geometries is discussed. Inherent mechanical and thermal limitations are shown to apply to coils relying solely on the strength of materials. The usefulness of inertial effects is demonstrated. Instrumentation is described for producing 10 microsecond range pulses of amplitude up to 1.6 megagauss in single-turn coils. Experimental observations document the appearance of the saw effect and Kruskal-Schwarzchild instabilities at very high fields. The limitations characteristic of conventional coils can be overcome in toroid-free geometries if the appropriate mathematics is developed and illustrated. 22 Refs.

Primary Keywords: Magnetic Field Generation; Coil Geometry; Coil Materials Strength; 10 Microsecond Pulse Length; 1.6 MG Field Strength; Single Turn Coil
COPYRIGHT: 1957 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

15.2

**6978
(DIAGNOSTICS AND INSTRUMENTATION)
(B-field)**

TECHNIQUE FOR MEASURING MEGAGAUSS MAGNETIC FIELDS USING ZEEMAN EFFECT
W.B. Gann, R.S. Caird, D.B. Thomson and C.M. Fowler
Los Alamos National Labs, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 37, No. 6, pp 762-767
(06/1966).

Rapidly varying magnetic fields with peak values in the range from 1 to 5 MG are measured by use of sweeping image spectrographic method. Atomic spectral lines from an exploding-wire light source situated in the experimental region are recorded as the magnetic field varies in a few microseconds from a moderate initial value of a few tens of kilogauss to the peak values. Field measurements are generally accurate to within 2-3% as determined by the consistency of measurements made from several different spectral lines. The sodium D lines and the indium I 4102 Angstrom line have proven to be exceptionally useful for field determinations. The highest field determined to date by this method is 5.1 MG, corresponding to a measured separation of 164 Angstroms between the centers of the shorter and longer wavelength doublets which the Na/sub D/ lines assume in very high fields. The doublets, of approximately 4 Angstrom separation, are not themselves resolved. 9 Refs.

Primary Keywords: Magnetic Field Measurement; Zeeman Effect; 5 MG Measurement Range; 3 Per Cent Accuracy; 164 Angstrom Give Separation

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6971
(PARTICLE BEAMS, ELECTRON)
(Generation)**

'MINUS' PULSED, HIGH-CURRENT, NANOSECOND, ELECTRON ACCELERATOR
I.B. Dzheliev, G.E. Gladyshev, B.T. Placharov, B.N. Pugachev, O.S. Sirotyuk, Yu.V. Terent'ev, V.A. Redichkin and K.I. Finkel'shtein
Levcev Leningrad Technological Institute, USSR
Instruments And Experimental Techniques, Vol. 23, No. 2, pp 327-330
(06/1980).
Trans. From: Pribyr i Tekhnika Eksperimenta 2, 38-40 (March-April 1980)

A description is given of a high-current electron accelerator with an energy of 500 keV, a beam current of 7 kA, and a pulse duration of 5-7 nsec. The electrons emitted from a multi-point cathode with an area of 20 x 200 mm, are accelerated in a vacuum diode gap. Titanium foil 50 micron thick serves as the anode. The double shaping line of the accelerator is charged from a pulse transformer. 2 Refs.

Primary Keywords: E-beam Generation; 500 keV Beam Energy; 7kA Current; 5-7ns Beam Duration; Multipoint Cathode; Titanium Anode

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

**6972
(PARTICLE BEAMS, ELECTRON)
(Generation)**

A GENERATOR PRODUCING NANOSECOND PULSES OF FAST ELECTRONS
N.V. Belkin, V.V. Bogolyubov, V.I. Kolesov and L.N. Kudryakova
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 341-343
(06/1975).
Trans. From: Pribyr i Tekhnika Eksperimenta 2, 19-21 (March-April 1975)

The principle of operation and the characteristics of a portable pulsed source of fast electrons are described. The generator is fabricated according to a circuit with recharging of a capacitor. An autoelectronic tube with a foil cathode, which is equipped with a beryllium window for release of the electron beam into the atmosphere, is used in the generator. The source creates electron pulses having a length of approximately 1.5 nsec at the half-height. The amplitude of the accelerating voltage is approximately 200 KV. The maximum electron current is at least 200 A. 5 Refs.

Primary Keywords: E-beam Generation; Portable Apparatus;

Autoelectronic Tube; Foil Cathode

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

**6973
(PULSE GENERATORS)
(Spiral)**

A HELICAL PULSE-VOLTAGE GENERATOR
A.B. Gerasimov, I.M. Roife, E.B. Seredunko and B.A. Stekol'nikov
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad,
USSR
Instruments And Experimental Techniques, No. 5, pp 819-821 (06/1970)
Trans. From: Pribyr i Tekhnika Eksperimenta 3, 161-165 (May-June 1970)

The results are presented of a study of a helical spiral voltage generator (SG). It is found that for certain values of the parameters the selection of the width of the strip-line affects the efficiency. An empirical formula is presented for estimating the optimal number of turns of the spiral. The load characteristics of the SG are also presented and the possibility is discussed of using a SG in laboratory practice. 1 Refs.

Primary Keywords: Spiral Generator; Stripline Width; Efficiency;

Design Considerations

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

**6974
(PULSE GENERATORS)
(Trigger)**

A 20-CHANNEL GENERATOR OF HIGH-VOLTAGE PULSES

P.S. Anan'ev and A.P. Kashirin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 119-121
(02/1980).
Trans. From: Pribyr i Tekhnika Eksperimenta 1, 121-123
(January February 1980)

A 20-channel generator of high-voltage pulses operating on an unmatched load is described. The wave impedance of the channels is 50 ohm. The maximum amplitude of the pulses is up to 15 KV or a high-impedance load and 7.5 KV on a matched load. The pulse duration is 100 nsec with a front duration of 12 nsec. The voltage produced by the generator is 200 volt. Compensation of the pulse being formed and isolation of the pulse reflected from the load are provided for in the monitoring system. The parameters of the load can be characterized from the shape and amplitude of the reflected pulse. 3 Refs.

Primary Keywords: Pulse Generator; 20 Channel Output; Fixed Delay; Load Characterization; 50 ohm Load; 7.5 KV Output

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

**6975
(PARTICLE BEAMS, ION)
(Generation)**

ACCELERATION OF IONS FROM AN EXPLOSIVE-EMISSION PLASMA
E.I. Logachev, G.E. Remnev and Yu.P. Usov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Technical Physics Letters, Vol. 6, No. 11, pp 605-606 (11/1980).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 6, 1404-1406
(November 1980)

Much progress has been achieved in recent years in the production of high-current beams of light ions with energies of a few hundred keV and power levels up to 1E12 W. In most cases the ion source has been the plasma produced when a discharge is conducted along the surface of a hydrocarbon insulator by the accelerating-voltage pulse. Ions of intermediate mass in particular, carbon ions, are accelerated due to injection of plasma from an auxiliary plasma source into the accelerating gap. In this letter we report the results of the first experiments on the acceleration in a plane diode of ions from an explosive-emission plasma, which is produced by applying to the anode (the high-potential electrode) a negative-polarity pulse before the positive accelerating-voltage pulse. 6 Refs.

Primary Keywords: Intense Ion Beam Production; Intermediate And Heavy Elements; Explosive-emission Plasma; Plasma Production

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6976
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)**

CURRENT DIFFUSION IN CYLINDRICAL EXPLODING WIRES AND FUSES DURING MICROSECOND ELECTRICAL PULSES

F.D. Bennett
Army Armament Research and Development Command, Aberdeen Proving Ground,
MD 21005
Journal of Applied Physics, Vol. 42, No. 7, pp 2835-2839 (06/1971).

Existing solutions to the diffusion equation for current in a cylindrical conductor are used to provide estimates of the nonuniformity of current density during typical wire explosions. The estimates are given in the form of inequalities which are then used to specify the conditions under which current distribution and heating effect can be considered uniform. 7 Refs.

Primary Keywords: Exploding Wire; Current Density Nonuniformity; Diffusion Equation; Uniform Heating; Current Ramp Solution; Theory

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6977
(BREAKDOWN STUDIES)**

(Liquid, Electrical)

BREAKDOWN OF WATER IN A SYSTEM WITH 'DIFFUSION' ELECTRODES
V.V. Vorob'ev, V.P. Kapitonov, E.P. Kruglyakov and Yu.A. Tsidulko
Institute Of Nuclear Physics, Academy of Sciences of the USSR,
Novosibirsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 5, pp 598-602 (05/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 993-999 (May 1980)

Results are presented of experiments pertaining to breakdown of water in an interelectrode gap with conducting layers near the surface of the electrodes. The electric field strength in the gap varied up to approximately 1.5 MV/cm. The conducting layers shielded the electrodes, causing the electrical strength to increase over that of pure water by approximately fourfold. 9 Refs.

Primary Keywords: Water Breakdown; 1.5 MV/cm Electric Field Strength; Conducting Layers; Uniform Magnetic Field; Diffusion Electrode

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6978
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)**

CERTAIN FEATURES OF EXPLODING WIRES

V.S. Sodol
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 8, pp 983-985 (08/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1707-1710 (August 1976)

One of the remarkable properties of exploding wires is the rapid increase of resistance during the explosion. The basic cause of this resistance increase exploding wires can be used as fast, high-voltage current breakers, as fuses, and in devices for shaping high-voltage pulses. The mechanism of the resistance increase during the destruction stage have not yet been established, and experimental work in this field is of both practical and scientific interest. In the present paper we report a continuation of the work of several other workers. We offer a quantitative description of the electrical characteristics of the explosion during the destruction stage: the input energy before the current pause and the height $U_{\text{sub}} \text{t}_{\text{sub}} / \tau$ and length $t_{\text{sub}} \text{t}_{\text{sub}} / \tau$ of the voltage pulse which arises during the rapid increase in the resistance. 13 Refs.

Primary Keywords: Exploding Copper Wires; Rapid Resistance Increase; Destruction Stage Characteristics; Opening Switch; Input Energy; Current Pause

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6979
(PARTICLE BEAMS, ELECTRON)**

(Generation)

CHARACTERISTICS OF A HOLLOW ELECTRON BEAM IN A MAGNETICALLY INSULATED DIODE

S.Yu. Belomytnev, S.P. Guseev, V.I. Koshelev, G.A. Mesyats, G.S. Polovik, V.M. Svoshnikov, K.N. Sukhushin and M.M. Timofeyev
Soviet Technical Physics Letters, Vol. 4, No. 12, pp 582-583 (12/1978).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1438-1442
(December 1978)

Hollow diodes with magnetic insulation are frequently used to form hollow electron beams. In electron sources of this kind it is important to know whether the beam current is limited by the diode or by the transport system. The ratio of the beam current $i_{\text{sub}} b / i_{\text{sub}}$ to the maximum current $i_{\text{sub max}}$ for the transport system, $i_{\text{sub max}}$, determines the beam potential (or energy) in the drift volume. The authors report on experiments with a long-pulse plasma cathode, magnetically insulated diode. Two geometries are considered: coaxial and end-free types. 9 Refs.

Primary Keywords: E-beam Generation; Field Emission Diode; Magnetic Insulation; Coaxial Geometry; End-free Geometry

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6980
(BREAKDOWN STUDIES)**

(Gas; E-beam)

CONDITIONS FOR THE MAINTENANCE OF THE CURRENT IN THE CATHODE LAYER OF A SEMI-SELF-MAINTAINING VOLUMETRIC DISCHARGE EXCITED BY AN ELECTRON BEAM
Yu.D. Koval'chuk (1), V.B. Ponomarev (2) and V.S. Synakh (2)
(1) Academy of Sciences of the USSR, Tomsk, USSR
(2) Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 20, No. 1, pp 15-18 (02/1979).
Trans. From: *Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* 20, 21-25 (January-February 1979).

The distribution of an electric field in a gas gap with the flow of a semi-self-maintaining discharge through the gap is characterized by the presence of preelectrode regions with an increased intensity of the field and the column of the discharge, where the field is approximately homogeneous. With a small rate of generation of electron-ion pairs psi and small applied voltages $U_{\text{sub}} \text{v}$, there are strong screening conditions. Under these conditions shock ionization, as a rule, is insignificant. With high values of psi and U_{sub} , the electrical field in the cathode region rises so much that the principal mechanism of the generation of charged particles can become shock ionization. Then, the properties of the cathode layer of a discharge excited by a beam and of a glow discharge are similar in many respects. Therefore, the use of methods of calculation developed for the investigation of a glow discharge has made it possible to obtain certain evaluations for the case of large currents. 7 Refs.

Primary Keywords: Volume Discharge; Current Maintenance; Semi-self-maintaining; Shock Ionization; Cathode Layer Transformations; E-field Calculation

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

**6981
(POWER CONDITIONING)**

(Pulse Forming Lines)

CORRECTION OF THE CHARACTERISTIC OF A SPARK COMMUTATOR WITH A HETEROGENEOUS SHAPING LINE
B.M. Koval'chuk, V.V. Kremnev and G.A. Mesyats
Scientific-Research Institute Of Nuclear Physics, Electronics, And Automation, USSR
Instruments And Experimental Techniques, No. 6, pp 1409-1411 (12/1966).
Trans. From: *Priboy i Tekhnika Eksperimenta* 6, 119-121 (November-December 1966)

A formula is derived for the profile of a heterogeneous shaping line for pulse correction, under the assumption that the voltage drop across the commutator, which causes elevation of the pulse peak at the load, is practically independent of the impedance of the discharge circuit. The obtained relation is confirmed experimentally with 6-ohm strip lines at 5 kV. The characteristic impedance of the heterogeneous line varied from 2.8 to 4.0 ohms. 4 Refs.

Primary Keywords: Heterogeneous Shaping Line; 2.8-4.1 Ohm Line; Impedance; Spark Commutator; Strict Pulse Peak Current Stability; Strip Line

COPYRIGHT: 1966 PLENUM PRESS, REPRINTED WITH PERMISSION

**6982
(PARTICLE BEAMS, ELECTRON; INSULATION, MAGNETIC)**

(Generation)

CROSS-FIELD CURRENT FLOW IN A MAGNETICALLY INSULATED DIODE
I.Z. Gleizer, A.N. Didenko, Yu.P. Usov, V.I. Tsvetkov and A.A. Shatenov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 25, No. 6, pp 760-762 (06/1980).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 20, 1321-1326 (June 1980)

Magnetically insulated diodes are widely used for producing high-current electron beams and find application for generating powerful superhigh-frequency radiation of microsecond duration. In this paper we study the passage of current across the magnetic field in high-current magnetically insulated electron diodes in the microsecond range, where failure of the magnetic insulation can limit the pulse length. 9 Refs.

Primary Keywords: Magnetic Insulation; Cross-field Current Flow; High-current Electron Beams; Magnetically Insulated Electron Diodes; Variable Pulse Length

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6983
(BREAKDOWN STUDIES)**

(Liquid; Electrical)

DEVELOPMENT OF A DISCHARGE IN A LIQUID DIELECTRIC WITH RAMP FUNCTION VOLTAGE PULSES

V.Ya. Ushakov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 10, No. 10, pp 1420-1423 (04/1965).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 35, 1844-1847 (October 1965)
Earlier we have published preliminary results of an investigation of the breakdown of distilled water in the case of ramp-function voltage pulses of positive polarity. In this paper we describe the results of investigations of breakdown in pure transformer oil, ethyl alcohol, and distilled water ($\rho=1000 \text{ g/cm}^3$) in a rod-plate electrode system, the rod having either positive or negative polarity. 7 Refs.

Primary Keywords: Water Breakdown; Discharge Development; Ramp Function Voltage Pulses; Rod-plate Electrode System; Liquid Dielectric Breakdown; Ionization Process

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6985
(BREAKDOWN STUDIES; SWITCHES, CLOSING; SWITCHES, OPENING)**

(Gas; E-beam; Gas Gaps; E-beam; Gas Gaps; E-beam)

DISCHARGE IN HIGH-PRESSURE GAS, INITIATED BY A BEAM OF FAST ELECTRONS
B.M. Koval'chuk, V.V. Kremnev, G.A. Mesyats and Yu.F. Potolitsyn
Academy of Sciences of the USSR, Tomsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 12, No. 6, pp 883-889 (12/1971).
Trans. From: *Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* 6, 21-29 (November-December 1971)

It has been shown that, to avoid forming a discharge channel in a high pressure gas, one must have many initiating electrons before the start of the discharge, distributed over the cathode or through the discharge gap volume. To achieve this Koval'chuk et al. proposed using a beam of fast electrons. The present paper presents results of investigation of a discharge in nitrogen at pressures up to 16 atm, initiated by a beam of electrons with an average energy of 100 to 350 keV. Channel-less type of discharge was obtained for voltages above 1E5 V and for switched currents of tens of milliamperes. This type of discharge has typically a specific absorbed power in the gas of the order of 1E7 to 1E9 W/cm² or more for a time of the order of 1E-8 sec. 7 Refs.

Primary Keywords: Discharge Channel Formation; 100 To 350 keV Average Beam Energy; High-voltage Nanosecond Pulse Generator; 1E-8 sec Beam Duration; 3E-9 sec Current Rise Time

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

**6986
(BREAKDOWN STUDIES)**

(Liquid, Electrical)

EFFECT OF THE INITIAL CONDITIONS ON THE DYNAMICS OF AN UNDERWATER SPARK. I. EFFECT OF THE PARAMETERS OF THE GENERATOR AND THE MEDIUM
E.V. Krivitskii, V.D. Kustovskii and A.P. Slivinskii
Planning And Design Bureau Of Electrhydraulics, Academy of Sciences of the Ukrainian SSR, Nikolaev, USSR
Soviet Physics-Techical Physics, Vol. 25, No. 8, pp 993-998 (08/1980).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 50, 1705-1712 (August 1980)

The dynamics of an underwater spark are investigated by using a numerical-analytical method. The system of equations for the channel, which consists of an equation for the discharge circuit and another for the internal energy balance in the discharge channel, are closed by using an experimentally established proportionality between the internal energy and the electrical conductivity of the plasma. Satisfactory agreement is obtained between the experimental and calculated curves for the current, resistance, and radius of the channel. The range of discharge conditions under which the system is valid is established. The channel dynamics are very sensitive to such initial conditions as the electrical conductivity of the plasma and the parameters of the discharge circuit. 9 Refs.

Primary Keywords: Underwater Spark Dynamics; Plasma Conductivity; Discharge Circuit Parameters Established; Discharge Channel Energy Balance; Channel Current; Channel Resistance; Empirical Formula

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6987
(BREAKDOWN STUDIES)**

(Liquid, Electrical)

EFFECT OF THE INITIAL CONDITIONS ON THE DYNAMICS OF AN UNDERWATER SPARK. II. EFFECT OF AN EXTERNAL SOURCE OF PUMP ENERGY

E.V. Krivitskii, V.D. Kustovskii and A.P. Slivinskii
Planning And Design Bureau Of Electrhydraulics, Academy of Sciences of the Ukrainian SSR, Nikolaev, USSR
Soviet Physics-Techical Physics, Vol. 25, No. 8, pp 998-1000 (08/1980).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 50, 1713-1716 (August 1980)

The effect of a source of pump energy on the dynamics of a pulsed underwater discharge is investigated. A system of equations, describing the dynamics of the underwater spark channel with a linear voltage drop is used. A numerical solution is obtained for this system. The electrical characteristics of different discharge conditions are determined. An additional source of pump energy has a strong effect on the electrical and hydrodynamic characteristics of the underwater spark channel. 1 Ref.

Primary Keywords: Underwater Spark Dynamics; External Pump Energy Source; Maximum Electroacoustic Efficiency; Maximum Pulse Pressure; Constant Discharge-channel Length

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6988
(BREAKDOWN STUDIES)**

(Gas; RF)

EFFICIENCY OF ENERGY TRANSFER TO AN ELECTRODELESS HIGH-FREQUENCY DISCHARGE

S.I. Andreov, M.P. Vanyukov and B.M. Sokolov
Soviet Physics-Techical Physics, Vol. 12, No. 7, pp 910-913 (01/1968).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 37, 1252-1257 (July 1967)

The efficiency of energy transfer from an oscillatory circuit to a gas discharge occurring inside a quartz vessel which is located in the coil is considered. The investigation is carried out in inert gases for pressures of 10-100 Torr for various circuit parameters and dimensions of the plasma vessel. The experimental data are in good agreement with theory. 8 Refs.

Primary Keywords: Gas Breakdown; RF Discharge; Quartz Vessel; Energy Transfer Efficiency

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6989
(BREAKDOWN STUDIES)**

(Solid, Electrical)

ELECTRIC BREAKDOWN IN SOLID DIELECTRICS

G.A. Vorob'ev and N.S. Neimelov
Izhevsk Institute Of Automatic Control Systems And Radioelectronics, USSR
Soviet Physics-Journal, Vol. 22, No. 1, pp 70-80 (01/1979).
Trans. From: *Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika* 22, 90-104 (January 1979)

It is known that three main forms of solid-dielectric breakdown may be distinguished: 1) electrothermal; 2) electrical; 3) electrochemical. The laws of electrothermal and electrochemical breakdown are required for the design and construction of power station insulation. The laws of electrical breakdown are important in constructing the insulation of equipment for the application of a pulsed load. In addition, in the case of electrical breakdown, it is useful to consider the interaction of electrons with a solid structure, and therefore the laws of electrical breakdown give certain information on the solid structure. It is now a century since the first scientific hypotheses appeared, but much work remains to be done on dielectric breakdown. Various explanations of breakdown have been proposed. These explanations have been given in many monographs and reviews and there is no point in repeating them here. It is sufficient to note that over the last 30 years theorecticians have tended to the view that the electrical breakdown of solid dielectrics is due to impact ionization by electrons and that the theory must be based on the solution of the kinetic equations. There is definite interest in giving an account for all these processes within the scope of a single paper, which has not been done before. 85 Refs.

Primary Keywords: Solid-dielectric Breakdown; Electrothermal; Electrical; Electrochemical; Impact Ionization; Prebreakdown Phenomena

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

**6990
(BREAKDOWN STUDIES)**

(Liquid; Electrical)

ELECTRICAL CHARACTERISTICS OF A SPARK DISCHARGE IN A CIRCULATING TRANSFORMER OIL

G.S. Korshunov, G.A. Kiselev and Yu.B. Fortes

Applied Electrical Phenomena, No. 4 (28), pp 282-286 (08/1969).

Trans. From: Elektronnaya Obrabotka Materialov 4, 41-46 (July-August 1969).

At the present time gas-filled and vacuum-type peaked spark dischargers of various constructions are widely used as sources of high-voltage, sharp-fronted pulses. This is largely because the working medium of such dischargers has a sufficiently long-term stability when subjected to the effects of the electrical discharges occurring periodically between the electrodes. For this reason the electric field strength in the gap remains nearly constant from breakdown to breakdown; to a large extent this makes possible the stabilization of the parameters set up during the peaking of the high-voltage pulses. 6 Refs.

Primary Keywords: Oil Breakdown; Circulating Transformer Oil; Peaking Discharger; Stable Voltage Pulse Parameters; Almost Instantaneous Breakdown Characteristics; Good High Frequency Operation; Minimal Energy Losses

COPYRIGHT: 1970 PLENUM PRESS, REPRINTED WITH PERMISSION

**6991
(BREAKDOWN STUDIES)**

(Liquid; Electrical)

ELECTRICAL CONDUCTION AND DEVELOPMENT OF BREAKDOWN IN LIQUID DIELECTRICS

V.Ya. Ushakov

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics Journal, Vol. 22, No. 1, pp 81-94 (01/1979).

Trans. From: Izvestiya Vsesoyuzhikh Uchebnykh Zavedenii, Fizika 22,

105-121 (January 1979).

The development of electrical power, associated with increase in the volume of electrical breakdown in insulating materials, and in the power and reliability of individual units, imposes ever more stringent requirements on electrical-engineering materials and, in particular, on insulating materials. The high electrical strength of insulating liquids, their good heat-conduction and arc-suppression properties, their technological convenience, their cheapness, and their self-repair after breakdown—these and a whole series of other qualities are responsible for the wide use of liquids as insulation in high-voltage equipment. The rapid increase in the electrical strength of liquids with decrease in the time of application of the potential and the high dielectric permittivity of most insulating liquids in combination with the properties already noted, mean that they provide a practicable alternative to vacuum in accumulators and line-forming generators of high-voltage pulses which is known have been widely used in recent years to obtain powerful beams of relativistic electrons, giant x-ray scintillations, strong pulsed electromagnetic fields, etc. Because of restrictions of space, the present work deals extremely briefly with some aspects of liquid-dielectric conduction and breakdown, while no consideration at all is given to others. 80 Refs.

Primary Keywords: Weak Electrolytes; Electrical Conduction; Breakdown Development; Liquid Dielectrics; Strong Electric Field; Ionization

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

**6995
(BREAKDOWN STUDIES)**

(Solid; Electrical)

ENERGY BALANCE FOR A SPARK IN A SOLID DIELECTRIC

H.T. Zinov'ev and B.V. Semkin

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics-Techical Physics, Vol. 23, No. 3, pp 369-370 (03/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 624-626 (March 1978).

In the boundary-value problem associated with the properties of the flow around an expanding spark in a condensed dielectric the boundary condition is incorporated in the energy-balance equation for the spark channel. For a 'buried' discharge in a solid dielectric, in which case measures are taken to prevent the products produced in the spark channel from escaping into the ambient medium, the energy-balance equation contains only three terms (in a first approximation), by analogy with discharges in liquids. The authors compare experimental results to those obtained with the proposed breakdown model. 8 Refs.

Primary Keywords: Solid Dielectric; Energybalance Equation; Spark Channel; Boundary Condition; 5000 pf Discharge Capacitance; 9 Microhenry Circuit Inductance; Theory; Comparison With Experiment; Plexiglas

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6997
(BREAKDOWN STUDIES)**

(Gas; E-beam)

EXTERNALLY MAINTAINED DISCHARGE WITH A GASDYNAMIC WINDOW FOR A LOW-ENERGY ELECTRON BEAM

Yu.I. Bychkov, Yu.D. Korsukov, N. Pesavets, D.A. Noskov, V.V. Osipov, L.N. Orlikov, A.G. Filatov and E.V. Ovchinnikov

Soviet Technical Physics Letters, Vol. 4, No. 5, pp 206-207 (05/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 4, 515-518 (May 1978).

Systems in which fast electron beams are used to excite volume discharges generally include an accelerator with an exit window made of a thin foil, which isolates the accelerating gap from the gas-filled gap and which isolates the discharge cell with its power supply. This exit window complicates the design and operation of the system because it tends to fail in cw operation; moreover, the electrons must be accelerated to high energies in order to pass through the window without losing energy (high-energy electrons are not the optimum choice for ionizing the gas because the ionization cross section decreases with increasing energy). In this letter we report the first results on the use of a special accelerator with a gasdynamic window for the excitation of a volume discharge.

Primary Keywords: Window; Low Loss; E-beam Sustained; Gas Dynamic Discharge; Window; Low Loss; Glow Discharge

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**6998
(BREAKDOWN STUDIES)**

(Vacuum; Electrical)

FORMATION OF A HIGH-CURRENT VACUUM SPARK BY THE HIGH-SPEED INTERFEROMETRY METHOD

S.P. Bugayev, R.B. Baksht, E.A. Litvinov and V.P. Stashev

Institute of Atmospheric Optics, Academy of Sciences of the USSR,

High Temperature, Vol. 14, No. 6, pp 1027-1032 (12/1976).

Trans. From: Ionofizika Vysokikh Temperatur 14, 1145-1150 (November-December 1976).

This article gives the results of an investigation of the distribution of the electron concentration in a vacuum spark with a duration of 100 nsec, with a current of 4 kA and an interelectrode distance of 0.7 mm. The work was carried out using a Michelson interferometer with a spatial resolution of 30 micron. It is shown that the maximal concentration is attained at the anode in the final phase of the discharge, and amounts to 10^{19} cu.cm. 8 Refs.

Primary Keywords: High-current Vacuum Spark; Electron Concentration Distribution; 100 ns Spark Duration; 4 kA Current; 0.7 mm Interelectrode Distance; 10^{19} cu.cm; Maximal Concentration; Anode And Cathode Flores; Michelson Interferometry

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

**6999
(BREAKDOWN STUDIES)**

(Liquid; Electrical)

FORMATION OF ELECTRICAL BREAKDOWN IN AQUEOUS SODIUM CHLORIDE SOLUTIONS

N.P. Belanikov, G.M. Ostrovskii and M.Yu. Stryek

A.A. Zhdanov, Engineering State University, Leningrad, USSR

Soviet Physics-Techical Physics, Vol. 9, No. 5, pp 730-733 (May 1964).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 969-951 (May 1964).

A high-speed SFR-2M camera has been used to refine some previous results, obtain new data on the rate at which the discharge channel and its gas envelope develop, and follow the development of shock waves (spherical and cylindrical). 2 Refs.

Primary Keywords: Electrolyte Breakdown; Diagnostic; Spark Channel; Gas Envelope; Shock Wave

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**7000
(BREAKDOWN STUDIES; SWITCHES, CLOSING)**

(Electrodes; Vacuum Gaps; Electrical)

FORMATION OF NEW EMISSION CENTERS ON A CATHODE DURING CURRENT SWITCHING IN VACUUM I. FORMATION OF NEW EMISSION CENTERS

D.I. Proskurovskii and V.F. Puchkarev

Academy of Sciences of the USSR, Tomsk, USSR

Soviet Physics-Techical Physics, Vol. 24, No. 12, pp 1474-1478 (12/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2611-2618 (December 1979).

The conditions prevailing in the cathode sheath are analyzed. It is shown that the formation of new emission centers below the plasma of the cathode spot by a mechanism involving explosion of microscopic fine tips can occur at distances approximately 10^{-2} cm from the primary emission center. While a mechanism involving the breakdown of nonmetallic inclusions on the film on the cathode can explain the formation of new emission centers at distances out to 10^{-2} cm. The appearance of emission centers on a narrow probe separated from the point of ignition on the cathode by a distance of $4E-3$ - 1.2 cm is studied in the spark and are stages of a vacuum discharge. The experimental results can be explained well by the second mechanism for the formation of new emission centers. 30 Refs.

Primary Keywords: Current Switching; New Emission Center Formation; Microscopic Fine Tip Explosions; Cathode Spots; Cathode Potential Drop Increase; Cathode Inclusions; Cathode Film

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**7001
(BREAKDOWN STUDIES; SWITCHES, CLOSING)**

(Vacuum; Electrical; Vacuum Gaps; Electrical)

FORMATION OF NEW EMISSION CENTERS ON A CATHODE DURING CURRENT SWITCHING IN VACUUM. II. EXPERIMENTAL CONFIRMATION FOR VACUUM DISCHARGES

D.I. Puchkarev and V.F. Proskurovskii

Academy of Sciences of the USSR, Tomsk, USSR

Soviet Physics-Techical Physics, Vol. 24, No. 12, pp 1479-1481 (12/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2619-2622 (December 1979). The results derived in part I of this work are used to show that nonmetallic inclusions and films on the cathode determine the nature and velocity of the rapidly moving cathode spots, the nature of the cathode erosion in nanosecond vacuum discharges, the spontaneous appearance of new cathode spots in vacuum sparks, and the appearance of cathode spots and moving double layers in 'straight-discharge' devices. 14 Refs.

Primary Keywords: Vacuum Breakdown; Experimental Confirmation; Nonmetallic Inclusions And Films; Cathode Spot Appearance; Cathode Spot Motion

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**7003
(BREAKDOWN STUDIES)**

(Vacuum; Electrical)

FORMATION OF PLASMA CHANNEL BY A VACUUM SPARK

R.B. Baksht, B.A. Kobzhamber and N.A. Katakhin

Academy of Sciences of the USSR, Tomsk, USSR

Soviet Physics-Techical Physics, Vol. 25, No. 10, pp 1350-1351 (June 1980).

In recent years there has been growing interest in processes which occur in the plasma of a vacuum spark in connection with the discovery that such plasma contains high-temperature regions, dubbed 'plasma points'. The initial phase in the formation of a plasma point follows immediately after vacuum breakdown, and the transition from a weakly ionized metal vapor to a plasma with classical conduction is of unquestionable interest for the study of this effect. In the present paper Thomson scattering was used to study the plasma of a pulsed vacuum spark, induced in a two-electrode apparatus with an igniting device, an apparatus such as is usually employed in investigations of this kind. 10 Refs.

Primary Keywords: Vacuum Breakdown; Plasma Channel Formation; Plasma Points; Thomson Scattering; Pulsed Vacuum Spark; Electron Density Distribution; Spark Channel Temperature

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7004
(BREAKDOWN STUDIES)
(Gas, Electrical)

FORMATION OF THE SPARK CHANNEL AND CATHODE SPOT IN A PULSED VOLUME DISCHARGE

R.B. Bakht, Yu.D. Korolev and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Journal Of Plasma Physics, Vol. 3, No. 3, pp 369-371 (06/1977).
Trans. From: Fiz. Plazmy 3, 652-656 (May-June 1977).

The formation of the cathode spot was studied in a nanosecond volume of discharge in an atmosphere of industrial-grade nitrogen at a pressure of 50-100 Torr. The electrode separation was 1 cm, and the height of the voltage pulse applied to the electrodes was 10-30 kV. Spectrograms and photographs of the emission of the discharge in various stages are shown. Photoelectric detection of the spectral lines of atomic copper was used for determining the time at which the cathode spot appears. The formation of the cathode spot is shown to be preceded by the appearance of diffuse channels with a relatively high current density. These channels lead to an increase in the electric field at the cathode and to a subsequent explosion of microscopic protuberances on the cathode. 12 Refs.

Primary Keywords: Spark Channel Formation; Cathode Spot; Nanosecond Volume Discharge; 50-100 Torr Pressure Nitrogen; 1-30 kV Pulse Height; Electrode Separation; 10-30 kV Pulse Height

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7005
(BREAKDOWN STUDIES)

(Gas, Electrical)

FORMATION IN LIQUID IN INITIAL STAGES OF A PULSED DISCHARGE

V.Ye. Vinogradov and V.M. Muratov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 15, No. 11, pp 1568-1572 (11/1972).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii Fizika 15, 42-47 (November 1972).

Gas formation in electrolytes with gamma E=2 - 1E-4 ohm cm, distilled water gamma E=3 - 1.5E-6 ohm cm, and chemically pure hexane in the initial stages of formation of discharge with rectangular voltage pulses of 0.67 and 1.85 microseconds duration is investigated. The experimental results are compared with the results of computer calculations. 13 Refs.

Primary Keywords: Liquid Breakdown; Electrolyte Breakdown; Gas Formation; Pulsed Discharge; Channel Formation; High Electrical Conductivity; Experiment; Theory

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

7007
(PULSE GENERATORS)

(Pulse Forming Lines)

GENERATOR OF HIGH-VOLTAGE RECTANGULAR PULSES

M.U. Bulatov, B.K. Toropov, V.G. Filippov and E.M. Chernov
Instruments And Experimental Techniques, Vol. 22, No. 6, pp 1589-1591 (12/1979).
Trans. From: Priobriy i Tekhnika Eksperimenta 6, 101-103 (November-December 1979).

A generator of high-voltage rectangular pulses, built in the form of four series-connected 10-element, two-stage shaping lines (TSL), is described. Each TSL is switched by a multigap discharger controlled by a spiral generator. The triggering range of the discharger is 80%. The maximum load voltage is 320 kV, the pulse duration is 20 microseconds, the current is 10 kA, and the irregularity of the top of a pulse is <1-2%. 7 Refs.

Primary Keywords: Pulse Generator; Pulse Shaping Line; Rectangular Output; Spiral Generator; 320 KV Output Voltage; <2% Drop

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

7009
(PARTICLE BEAMS, ELECTRON)

(Generation)

IMPROVED STABILITY OF EXPLOSIVE-EMISSION MULTIPLE-TIP CATHODES

V.A. Burtsev, M.A. Vasilevskii, I.M. Roife, E.V. Seredenko and V.I. Engel'ko
Soviet Technical Physics Letters, Vol. 4, No. 9, pp 436-437 (09/1978).
Trans. From: Pis'ma Zhurn. Tekhnicheskoi Fiziki 4, 1083-1087 (September 1978).

Bazhenov et al. have shown that explosive-emission cathodes can be used to produce electron-current pulses approximately 10^{-4} sec long. Comparable pulse lengths are achieved elsewhere with multiple-tip cathodes. However, the operation of a diode with an explosive-emission cathode in long current pulses has certain characteristics that can restrict the practical use of these diodes. For example, the electron current fluctuates; the number of working tips decreases at low diode voltages; and the operation of the diode can be unstable. To study the factors responsible for these effects, we have carried out experiments with a multitip explosive-emission cathode. The emitters are bundles of graphite fibers; in the present experiments these fibers are attached to the metal substrate through insulators. 3 Refs.

Primary Keywords: Electron-beam Generation; Multitip Cathode; Explosive Emission; 10^{-4} sec Pulse Length; Guard Electrode

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7010
(BREAKDOWN STUDIES)

(Liquid, Electrical)

INITIATION AND DEVELOPMENT OF NANOSECOND DISCHARGES IN LIQUIDS

V.V. Lopatin, V.Ye. Ushakov and V.P. Chernenko
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 18, No. 3, pp 376-381 (03/1975).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 18, 100-106 (March 1975).

The initiation and development of discharges in purified water and hexane were studied for pulse rise times of T_{rise} approximately 2-3 nsec and pulse lengths of T_{pulse} approximately 10-50 nsec by an oscilloscopic method and with an electron-optical image converter. The results are compared with data on the nanosecond breakdown of gases. A physical interpretation is offered for the observed behavior. 13 Refs.

Primary Keywords: Liquid Breakdown; Purified Water; 2-3 nsec Pulse Rise Times; 10-50 nsec Pulse Lengths; Pulsed Electrical Breakdown; Discharge Development; Pure Hexane; 400 kV Pulse Amplitude; Point-plane Electrode System

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

7011
(BREAKDOWN STUDIES)

(Gas, RF)

INVESTIGATION OF THE ENERGY TRANSFER EFFICIENCY FOR A PULSED INDUCTION DISCHARGE

S.I. Andreev, O.G. Baikov, P.N. Dushuk, E.A. Sergeenko and M.D. Yarysheva
Soviet Physics-Techical Physics, Vol. 14, No. 6, pp 774-776 (12/1969).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1032-1038 (June 1969).

An investigation was carried out of the energy transfer efficiency for a noninductive capacitor discharge at conditions near the upper limit of rate of current increase in xenon, argon, and neon plasmas. It is found that the most efficient energy transfer to the plasma (of the order of 80%) occurs when multturn exciting solenoids are used, and take place under conditions of high plasma conductivity as determined by its temperature. The temperature reached 25,000 Deg.K. for a xenon discharge at pressures from 2 to 50 Torr. Data are presented for the relative spectral radiant energy distribution. 19 Refs.

Primary Keywords: Gas Breakdown; Neon; Argon; Xenon; Energy Transfer Efficiency; Multiturn Solenoid

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7012
(BREAKDOWN STUDIES)

(Solid, Electrical)

MICHAEL ASPECTS OF THE ELECTRICAL BREAKDOWN OF SOLID DIELECTRICS

B.V. Semen' and V.S. Korolev
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 15, No. 9, pp 1348-1350 (09/1972).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 15, 1271-1272 (September 1972).

The possibility of mechanical failure of a solid dielectric due to ponderomotive forces being the first cause of its impulse electrical breakdown has been studied on a number of occasions. It was shown that the mechanical stresses in dielectrics in an electric field of the order of 1 MV/cm are considerable, and in a number of cases are sufficient for the failure of the material. However, so far the hypothesis of the mechanical failure of dielectrics due to field forces have not been substantiated experimentally. 10 Refs.

Primary Keywords: Solid Dielectric; Breakdown; Mechanical Stresses; Point-plane Electrode Field; Crack Formation; Incomplete Breakdown Channels; Ponderomotive Force

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

7014
(PARTICLE BEAMS, ELECTRON)

(Generation)

MICROSECOND HIGH-CURRENT ELECTRON-BEAM ACCELERATOR

V.A. Burtsev, M.A. Vasilevskii, O.A. Gusev, I.M. Roife, E.V. Seredenko and V.I. Engel'ko
Instruments And Experimental Techniques, Vol. 22, No. 5, pp 1223-1226 (10/1979).
Trans. From: Priobriy i Tekhnika Eksperimenta 5, 32-35 (September-October 1979).

The main constructional and physical characteristics of a high-current electron accelerator with energy of approximately 0.5 MeV, current of approximately 5 kA and current pulse length of approximately 10 microseconds are given. 6 Refs.

Primary Keywords: E-beam Generation; 0.5 MeV Energy; 5 kA Current; 10 μ s Beam Duration; Magnetic Insulation; Cathode Plasma

COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

7016
(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Solid, Electrical; Solid)

NANOSECOND BREAKDOWN OF POLYMERS

G.A. Vorobjev and V.S. Korolev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 21, No. 10, pp 1222-1225 (10/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 2088-2093 (October 1976).

Nanosecond breakdown is studied for several polymers: polyethylene, polystyrene, polymethyl methacrylate, polyvinyl chloride, nylon-6, and teflon. 7 Refs.

Primary Keywords: Nanosecond Breakdown; Several Polymers; Homogeneous Field; Dielectric Strength; Inhomogeneous Field; Point-plane Electrode System; Polarity Effect; Impact Ionization

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7017
(BREAKDOWN STUDIES)

(Gas, Electrical)

NANOSECOND GAS DISCHARGE IN AN INHOMOGENEOUS FIELD WITH EXPLOSIVE PROCESSES ON THE ELECTRODES

Yu.D. Korolev, V.A. Kuzmin and G.A. Mesyats
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 25, No. 1, pp 418-420 (04/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 699-704 (April 1980).

Air breakdown at pressures 20-500 Torr was investigated in a needle-end-plane electrode configuration with rectangular voltage pulses applied to the gap. Depending on the negative tip polarity, a cathode or anode spot is produced during the first few nanoseconds and the discharge burns in the form of a diffuse channel with a spot on the tip electrode. The contraction process is connected with the growth of spark channels from the cathode and anode spots. 11 Refs.

Primary Keywords: 20-500 Torr Pressures; Air Breakdown; Needle-end-plane Electrode Configuration; Spark Channels; Cathode And Anode Spots; Nonuniform Field; Tip Electrode; Dark Cathode Potential-drop Region

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7041
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

ELECTRICAL CHARACTERISTICS OF CONTROLLED HIGH-CURRENT TRIGGERED AIR SPARK GAPS

P.I. Shkuropet

M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Techical Physics, Vol. 11, No. 6, pp 779-783 (12/1965).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1058-1064 (June 1966). Triggered spark-gap devices of the trigatron type are gaining popularity in high-pulse-current work and in the production of strong magnetic fields, owing to their simplicity of design and reliability of performance. There are several theories regarding the mechanism by which the discharge is initiated in such devices. The purpose of this investigation was to study the electrical characteristics of high-current trigatron spark gaps and to indicate the discharge initiation mechanisms in trigatrons. Two types of trigatrons were investigated. In one of them, the one most frequently utilized in practice, the trigger electrode was insulated from the main electrode by a porcelain bushing. This second type of trigatron, investigated earlier, did not incorporate a readily damaged insulator bushing, so that it had a higher current handling capacity. 14 Prefs.

Primary Keywords: Trigatron; Spark Gap; Trigger; Probability; Operating Voltage Range vs Gap Length; Polarity Effects; Voltage Fall Measurement

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7042
(BREAKDOWN STUDIES)

(Fusing, Fusing)

ELECTRICAL EXPLOSION OF A CYLINDRICAL FOIL IN AIR. CURRENT DISTRIBUTION IN THE HIGH-CURRENT SHUNTING DISCHARGE

V.A. Burtsev, V.A. Dubovskii, N.P. Egorov, M.P. Kasatkina, A.B. Prodnov and I.V. Shostakov
Dnepromet Institute, Leningrad, USSR
Sov. J. Technical Physics Letters, Vol. 4, No. 6, pp 264 (06/1978).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 4, 654-656 (June 1978). In this letter we report continuation of the study of the electrical explosion of cylindrical aluminum foils in air. Earlier electrical and optical measurements and the results obtained in work on these foils are given in detail. In the present part of the work we give a more complete physical picture obtained by using magnet probes to study the spatial and temporal variations in the magnetic field generated by the current in the plasma produced in the electrical explosion of an aluminum foil. 2 Refs.

Primary Keywords: Cylindrical; Foil Explosion; Aluminum Foil; Air Environment; Magnetic Field Measurement; Current Density; Spatial Resolution

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7044
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

ELECTRON-OPTICAL OBSERVATION OF INITIATION AND DEVELOPMENT OF PULSED BREAKDOWN IN A HOLLOW VACUUM GAP

S.P. Bugayev, A.M. Iskakidzki, G.A. Meysels and D.I. Proskurovskii
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 12, No. 12, pp 1625-1627 (05/1967).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 3, 2226-2228 (December 1967). There are several hypotheses explaining the initiation and development of high-vacuum breakdown breakdown. As far as pulsed vacuum breakdown in the nanosecond range is concerned, the set of hypotheses assigning primary significance to field emission from microregions of the cathode appears most encouraging. However, one author prefers an alternative mechanism for the initiation of breakdown in electron beams, and others consider the reason for breakdown to be the explosion of microscopic projections on the cathode because of heating by field emission. This paper contains results of an experiment to study the luminosity of the developing pulsed nanosecond vacuum breakdown. Cathode processes are described. 10 Prefs.

Primary Keywords: Vacuum Breakdown; Nanosecond Breakdown; Outputs; Framing Camera; Cathode Processes

COPYRIGHT: 1958 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7045
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

ENERGY-TRANSFORMING APPARATUS FOR A SWITCH

A.M. Timonin
D.V. Efremov Institute, Leningrad, USSR
Soviet Physics-Techical Physics, Vol. 11, No. 2, pp 333-338 (02/1966).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 12, 333-338 (February 1966). The efficiency with which energy is converted into the energy of a magnetic field in a magnetic compression system is found as a function of the flux compression ratio λ , field orientation. If the flux compression is limited and extremely strong initial compression is realized, the ratio λ is given by $\lambda = \sqrt{2}$. 2 Refs.

Primary Keyword: Flux Compression Theory; Efficiency Calculation; High Intensity Field

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7046
(ENERGY STORAGE, INDUCTIVE, PULSE GENERATORS)

Inductors, Flux Compressor/

EXTRACTION OF ENERGY FROM INDUCTIVE STORES AND EXPLOSIVE-MAGNETIC GENERATORS INTO AN INDUCTIVE LOAD USING CIRCUIT BREAKING

V.A. Ponomarev, I.S. Zharinov, V.A. Kazakov, A.I. K. Chernyshev
Moscow, USSR
Journal of Applied Mechanics and Technical Physics, Vol. 17, No. 4, pp 646-656 (12/1973).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 56-67 (July 1978).

In recent years the task of obtaining high-power current pulses using inductive energy stores has been given increasing attention. The increased interest in such devices is due to the fact that the magnetic energy density in inductive stores can generally exceed the energy density of other energy sources. These devices are most obvious in the case of pulsed stores supplied from explosive-magnetic generators operating on the principle of the rapid compression of magnetic flux. The store itself, while intact in explosive-magnetic generators, is a source of energy, however, the currents in the load and the currents in the circuit breaker must be limited by both the energy stored in the store and the explosive-magnetic generator. This article discusses the problem of extracting the energy stored in the store into the load, taking into account the inductive inductance of the circuit and determining the optimal circuit and either the inductances of the load circuit and the load or the load current and voltage in the load. 12 Prefs.

Primary Keywords: Inductive Energy Storage; Flux Compressor Generators; Opening Switch; Inductive Load; Load Protection; Transfer Effector

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7047
(PARTICLE BEAMS, ELECTRON)

GENERATION AND FOCUSING OF A STRONG-CURRENT ELECTRON BEAM IN A LOW-IMPEDANCE DIODE

V.I. Likunov, Yu.L. Sidorov and V.P. Smirnov
JETP Letters, Vol. 19, No. 8, pp 273-275 (04/1974).

Trans. From: Zhurnal Pisem Redaktsii, Vol. 19, 516-520 (April 1974). Results are presented on the generation of an electron beam in a low-impedance diode. There is no conventional cathode for such diodes. The construction of the cathode amplifies the influence of the preliminary charging pulse on the formation of the plasma current carrying channel between the electrodes of the accelerating gap. A beam current density >566 A/cm² was obtained at a power flux $>10^2$ W/cm². The amplitude of the preliminary discharge pulse current was >10 kA, 7 Prefs.

Primary Keywords: E-beam Generation; Field Emission Diode; Diode Closure; Propulsion Suppression

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7048
(ELECTRON STUDIES)

(Solid, Electrical)

HIGH-CURRENT, HOLLOW-CATHODE GLOW DISCHARGE

I.I. Aksenyuk, V.A. Belous and S.A. Smirnov

Dnepromet Institute, Academy of Sciences of the Ukrainian SSR, Kiev, USSR
Soviet Physics-Techical Physics, Vol. 20, No. 8, pp 1994-1998 (08/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1717-1724 (August 1975). A study has been made of the voltage drop in hydrogen, deuterium, and oxygen, for pressures of 0.2 to 1 Torr at currents up to 2000 A in pulsed gaps of 3 and 15 m microseconds with repetition rates of 50 Hz. The cathode is stainless steel or aluminum and the size of the anode is 15 mm. Measurements are made after the pulse and, accompanying with the apparatus sealed off, the dynamic resistance of the discharge decreases as the current increases and, in certain circumstances, can take on negative values. The dependence of the voltage drop on the size of the cathode cavity is characterized by a minimum at 2 to 5 mm. 15 Prefs.

Primary Keywords: Gas Breakdown; Hydrogen; Deuterium; Oxygen; Arc Discharge; Drop; 0.2-1 Torr Pressure; Stainless Steel; Cathode; Aluminum; Cathode

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7049

(SWITCHES, METALS)

HYDROGEN GENERATORS FOR SEALED SWITCHES

V.K. Borcharov
Physico-technical Institute, Academy of Sciences of the Ukrainian SSR, Kiev, USSR

Soviet Physics-Techical Physics, Vol. 21, No. 4, pp 487-489 (04/1976). Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 839-843 (April 1975).

Hydrogen generators made from titanium and zirconium with automatic pressure regulation and getters are described. The ranges of the ambient temperature and pressure over which these generators can operate are broader than for other generators, and when the getters are used these generators are more efficient in pumping. At 1000°K in a discharge, when these generators are used in switches the range of working pressure is double that for generators without automatic pressure regulation. 7 Prefs.

Primary Keywords: Hydrogen Generator; Titanium; Zirconium; Pressure Regulation; Large Pressure Range

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7050
(SWITCHES, INDUCTIVE, SWITCHES, OPENING)

Switches, Switches

INDUCTIVE ENERGY STORAGE IN PULSED ACCELERATORS

A.G. Gor'kov, D.A. Gulyav, E.G. Klymenko and M.P. Smirnov

JETP Institute, Chernogolovka, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 19, No. 5, pp 1049-1050 (May 1974). Consideration is given to the use of inductive energy-storage banks as accelerating gaps for direct accelerators. The operating currents and voltages in the gaps are given, and the results of experiments with a test model accelerator are reported. 10 Refs.

Primary Keywords: Inductive Energy Storage; Design Considerations; Relativity; Performance Test; Opening Switch

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7051
(SWITCHES, CLOSING)

(Cups, Electrical)

CHARACTERISTICS OF PREIGNITION PROCESSES IN TRIGATRONS OPERATING IN AIR

P.I. Shkuropet

M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR

Soviet Physics-Techical Physics, Vol. 14, No. 7, pp 943-948 (01/1970).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1256-1263 (July 1969). Results of an experimental investigation of preignition processes in trigatrons are reported. The development of the discharge is found to proceed in two stages. Some of the characteristics of these stages are determined. 10 Refs.

Primary Keywords: Trigatron Switch; Preignition; Self-breakdown;

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7064
(PARTICLE BEAMS, ELECTRON)
(Generation)

REGULATING THE MAGNETIZATION OF FERRITE IN EXPERIMENTS ON THE SELF-ACCELERATION OF AN ELECTRON BEAM
A.A. Rakityanskiy
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 327-329
(04/1979).
Trans From: Pribory i Tekhnika Eksperimenta 2, 37-40 (March-April 1979)

A means of regulating the magnetization of ferrite is described which allows the choice of the optimum conditions in the process of self-acceleration of beams in ferrite structures. The magnetizing is accomplished with two coaxial solenoids which are simultaneously used to focus the beam. The results of an experimental investigation of the described means are presented.

Primary Keywords: E-beam Generation; Self-acceleration; Ferrite Ring; Magnetization; Coaxial Solenoid

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

7066
(SWITCHES, CLOSING)
(Gas Gaps, Systems)

STUDY OF PARALLEL OPERATION OF CONTROLLED SPARK GAPS

S.L. Zaitsev, G.S. Kicheeva and P.I. Shkurovskiy
M.I. Kolinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Techical Physics, Vol. 21, No. 11, pp 1023-1026
(06/1976).

Trans From: Zhurnal Tekhnicheskoi Fiziki 32, 1386-1391 (November 1962)
The parallel operation of several controlled spark gaps at a working voltage of 50-150 kV was investigated in a circuit similar to that of a generator of large pulsed currents with delay cables. The practicability of parallel operation of the gaps is demonstrated.

Recommendations for the design of such generators are given. 6 Refs.
Primary Keywords: Spark Gap; Triggering; Parallel Operation; 150 kV Operating Voltage; Design Considerations

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7067
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL; SWITCHES, OPENING)
(Flux Compression; Flux Compression Generators; Explosive Fuses)

TAKE-OFF OF ENERGY FROM EXPLOSIVE-MAGNETIC GENERATORS TO AN INDUCTIVE LOAD USING THE BREAKING OF A CIRCUIT

V.A. Demidov, E.I. Zharinov, S.A. Kazakov and V.K. Chernyshev
Moscow, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 20, No. 1, pp 32-36 (02/1979).

Trans From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 43-48 (January-February 1979).

The use of explosive-magnetic generators (EMG) for plasma experiments and for other physical investigations, along with the question of increasing the electromagnetic energy, poses the problem of the formation, in the external load, of current pulses with steep leading fronts in the microsecond range. One method for the rapid take-off of energy to the load is the breaking of the finite circuit of the explosive-magnetic generator. This is done using commutators based on the electrical explosion of thin conductors or on the basis of the mechanical breakdown of conductors by a charge of explosive. The aim of the present work was a determination of the form of the pulses of the current and the energy in an inductive load as a function of the resistance of the discontinuity introduced into the circuit of an explosive-magnetic generator, taking into account of the parasitic inductance of the commutating device. 14 Refs.

Primary Keywords: Explosive Flux Compression Generators; Inductive Load; Analysis; Theory; Comparison With Experiment

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

7068
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

DETECTION OF ELECTRODE VAPOR BETWEEN PLANE PARALLEL COPPER ELECTRODES PRIOR TO CURRENT AMPLIFICATION AND BREAKDOWN IN VACUUM

D.K. Davies and M.A. Blond
Washington Research Development Center, Washington, DC
Journal of Applied Physics, Vol. 41, No. 10, pp 3460-3463 (10/1968).

Simultaneous time-resolved measurements of current density and resonance line absorption have been made for the case of 0.1 and 0.8 microsecond, respectively, between plane parallel copper electrodes in vacuum. The absorption of resonance lines has been carried out for an electrode vapor pressure of 10⁻⁶ torr. At residual pressures in the low 10⁻⁶ torr range, the experimental data show that neutral copper vapor is absent in the interelectrode volume before the current increases sufficiently to cause breakdown. It is found that the vapor is generated in the cathode region, some microseconds prior to breakdown, and is highly localized in the region of the subsequent spark channel. Further, the vapor density decreases from cathode to anode along the path of the subsequent spark channel. The results are consistent with a model for vacuum breakdown proposed recently, in which the transition probability value, measured prior to breakdown, occurs by the acceleration of an anode macroparticle during its transit to the cathode. Amplification of the prebreakdown current in this vapor then leads to breakdown. From the data obtained in the present experiment, it appears that breakdown occurs primarily while the macroparticle is located between midgap and the cathode. 9 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Current Growth; Copper Vapor; 10⁻⁶ Torr Pressure; Resonance Line Absorption

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7069
(BREAKDOWN STUDIES)
(Gas, Electromagnetic)

VOLUME DISCHARGE EXCITED IN A GAS BY AN ELECTRUM BEAM IN THE CASE OF IONIZATION

Z.B. Evdokimov, G.A. Mezhyt and Yu.A. Ponomarev
Academy of Sciences of the USSR, Leningrad, USSR
Soviet Journal Of Plasma Physics, Vol. 3, No. 2, pp 202-206 (04/1977).
Trans. From: Fiz. Plazmy 3, 357-364 (March-April 1977).

A phenomenological system of equations is used to analyze the processes occurring with the column of a gas discharge excited by an electron beam in the case in which there is an inhomogeneous distribution of the rate of ionization of electron ion pairs across the discharge gap. The early stage of the process and the steady state are studied. The steady-state characteristics of the electric field and the specific current in the discharge column are determined. The voltage-current characteristic is obtained. The time-dependent solution for the electric field in the column has an inflection at an early time (after a time short enough to neglect the time required to reach steady-state reionization). At a certain current density of the order of a few nanocoulombs per square centimeter, the thermalized electron current due to the field distribution at early times. 11 Refs.

Primary Keywords: Gas Breakdown; Beam Ionization; Volume Discharge; Ionization

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7071
(SWITCHES, OPENING)
(Explosive Fuses)

A MEGAAMPERE SWITCH WITH AN EXPLODING FOIL FOR THE INVESTIGATION OF MAGNETIC CUMULATION

V.G. Kuchinskii, V.T. Mikhalkov and G.A. Shishkov
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 783-786
(06/1973).

Trans. From: Pribory i Tekhnika Eksperimenta 3, 108-112 (May-June 1973).
A device with an exploding foil allows the rise time of the current in the discharge current of a capacitor bank into a shunt solenoid to be reduced by a factor of 10 to 15, and a current having an amplitude of 1 MA can be obtained. A switch device is described which is used in a circuit for investigating magnetic cumulation. A procedure for choosing the parameters of the foil is expanded, and the possibility of using simple phenomenological models to describe the variation of the foil resistance during the commutation process is considered. 8 Refs.

Primary Keywords: Exploding Foil; Pulse Front Sharpening; 1 MA Current; Foil Parameterization; Design Considerations; Phenomenological Explosion Model

COPYRIGHT: 1973 PLENUM PRESS, REPRINTED WITH PERMISSION

7073
(BREAKDOWN STUDIES)
(Liquid, Electrical)

CHARACTERISTICS OF AN UNDERWATER SPARK

V.V. Shchepko and E.V. Kostyuk
Planning and Design Bureau of Electrohydraulics, Academy of Sciences of the Ukrainian SSR, Kiev, Ukraine, USSR
Soviet Physics-Techical Physics, Vol. 22, No. 1, pp 52-57 (01/1977).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 67, 93-101 (January 1977).

The energy balance in the channel of an underwater spark is analyzed for the main stage of the discharge, the first current pulse. It is shown that for a homogeneous discharge the specific internal energy is proportional to the conductivity of the spark during this time interval. The radiation energy is calculated roughly for a broad range of discharges under the assumption that the channel emits as an absolute blackbody. The radiation energy constitutes a small fraction of the overall energy balance and can be neglected. The diameter of the spark channel visible in transmitted light is related to the channel resistance. Approximate expressions are found for the motion of the spark channel and for its initial parameters: the radius and the electrical resistance. 12 Refs.

Primary Keywords: Underwater Breakdown; Energy Balance; Homogeneous Discharge; Blackbody Radiation; Channel Resistance Calculations; Theory

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7074
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Liquid, Electrical; Surface Flashover)

CREEPAGE DISCHARGE ALONG THE SURFACE OF SOLID DIELECTRICS IN WATER

P.M. Dastvits, A.S. Emelyanov and T.A. Ivanova
Soviet Physics Journal, Vol. 11, No. 2, pp 71-74 (02/1968).

Trans. From: Izvestiya VUZ, Fizika 11, 111-117 (1968).
Experimental data is given for the discharge voltage for creepage discharge in water as a function of the thickness, flange length, dielectric path length, dielectric surface, porosity of the solid dielectric, field configuration, polarity of the applied voltage pulse, and a number of other parameters. The experimental data discussed are the delay time with dielectric flange sparkover by creeping discharge, the average discharge propagation rate for both polarization, and the creeping discharge current and leakage resistance. 5 Refs.

Primary Keywords: Creepage Discharge; Tap Water; Dielectric Surface; Flange Length; Solid Insulator; Permittivity; Field Configuration; Pulse Length

COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION

7075
(BREAKDOWN STUDIES)

TRANSIENT IN THE CUTOFF AND REFRACTION BREAKDOWN IN ELECTRICAL DISCHARGES IN LIQUIDS

Kuriksha

Zhurnal Tekhnicheskoi Fiziki, Leningrad, USSR

Soviet Physics-Techical Physics, Vol. 11, No. 2, pp 245-248 (08/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 338-341 (February 1966).

New experimental data have been obtained on anomalous electrical breakdown in liquids. Current cutoffs occur at different times, and current refractions take place under the effect of positive or negative residual voltage unless the electrical strength of the discharge gap is restored. 2 Refs.

Primary Keywords: Liquid Breakdown; Several Liquids; Current Cutoff; Refraction; Unstabilized Discharge

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7076
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

EFFECT OF A TRANSVERSE MAGNETIC FIELD ON THE BREAKDOWN IN A HIGH-VACUUM DISCHARGE GAP

V.A. Petrosov and N.V. Cherkas'ki
Soviet Physics-Techical Physics, Vol. 22, No. 3, pp 565-569 (05/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 61, 956-959 (May 1977).

The effect of a transverse magnetic field on the breakdown field at a vacuum discharge gap is studied experimentally for residual gas pressures $p = 10^{-6}$ torr in the working volume. The length of the discharge gap, d, and the shape of the working surface of the electrodes are varied in the experiments. The magnetic field is varied over the range H=0-8000 Oe. The experimental data on the breakdown voltage of high-vacuum discharge gap, U_{bd}, vs. H^2 are plotted as empirical functions. U_{bd} vs. H^2 is parabolic. 6 Refs.

Primary Keywords: Vacuum Breakdown; Transverse Magnetic Field; Variable Gap Spacing; Variable Electrode Geometry; 6000 Oe Field; Empirical Formula

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

160

7078
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; INSULATION, MATERIAL;
INSULATION, MATERIAL)
(Electrodes: Gas; Electrical; Gas; Liquid)
EFFECT OF CATHODE SURFACE STATE ON THE DIELECTRIC STRENGTH OF GASES AND
LIQUIDS

Yu.L. Stankevich and V.G. Kalinin
Soviet Physics-Techical Physics, Vol. 14, No. 7, pp 949-954 (01/1970).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 39, 1269-1271 (July 1969)

Effects of the cathode surface state on the dielectric strength of gases at high pressures and on capacitors with thin (< 0.2 mm) gaps have been studied. The mechanisms for the possible effects of various types of surface irregularities and contaminants on the pressure dependence of the static and pulsed breakdown voltages for gases have been examined. The experimental results show that the polycrystalline structure of the cathode is one reason for the scatter and nonreproducibility of breakdown voltages in gases at high pressures, especially with small interelectrode gaps. The use of single-crystal cathodes permits higher prebreakdown voltages in both gases and liquids. Covering the cathode surface with a thin liquid-dielectric film significantly increases the pulsed dielectric strength in a gas-filled gap. The results agree with the hypothesis that the main source of primary electrons during breakdown by short voltage pulses is field emission from the cathode surface. 7 Refs.

Primary Keywords: Gas Dielectric Strength; Liquid Dielectric Strength; Cathode Surface Effects; Several Gases; Transformer Oil; Single-crystal Cathode; Polycrystalline Cathode; Dielectric Liquid Cathode Film

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7079
(BREAKDOWN STUDIES)
(Vacuum; Electrical)
EFFECT OF ELECTROSTATIC FORCES IN VACUUM BREAKDOWN

I.L. Gufel'd and V.V. Postnov
All-Union Institute, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 23, No. 8, pp 996 (05/1978).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 48, 1750-1751 (August 1978)

Electrostatic forces play two roles in the prebreakdown state: They activate diffusive mass transport and damage the surface layers, thus increasing the field at surface irregularities and reducing the average breakdown field. If these processes are to occur, the field magnification at the microscopic protuberances must be a factor of a hundred or more. In certain cases, e.g., removal of aggregates which are weakly bound to the surface (polishing products) or the removal of elements of deposited film, the field magnification need not be high. 5 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Field Magnification; Microprojections

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7080
(BREAKDOWN STUDIES)
(Liquid; Electrical)
ELECTRICAL BREAKDOWN IN WATER BY 0.5-1.7-MV PULSES 0.5-5 MICROSECONDS

V.D. Tarasov, V.A. Balakin and O.P. Pecharskii
Soviet Physics-Techical Physics, Vol. 16, No. 8, pp 1379-1380 (02/1972).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 41, 1749-1750 (August 1972).
The electrical strength of outgassed and purified water is investigated in a uniform field produced by a sinusoidal voltage with amplitude 0.5-1.7 MV and a pulse length of 0.5-5 microseconds. The breakdown field is about 300 KV/cm for 5-microsecond pulses and increases to 480 KV/cm for 0.5-microsecond pulses. 5 Refs.

Primary Keywords: Water Breakdown; 0.5-5 Microsecond Pulse Length; 300-480 KV/cm Breakdown Field; Coaxial Lines; Electrical Strength Of Water; 0.5-1.7 MeV Voltage

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7081
(BREAKDOWN STUDIES)
(Exploding Wires)
ELECTRICAL CHARACTERISTICS OF UNDERWATER EXPLOSIONS

V.K. Sholom, E.V. Krivitskii et al. *Voprosy Elektronika*, No. 10, p. 117-118 (04/1975).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 4, 2169-2170 (October 1975).

Using the condition of approximate similarity for the electrical characteristics of an underwater explosion of a wire, empirical equations are obtained which help to determine the inductive peak overvoltage, the minimum current value for which the arc is struck, and the maximum current in the anode stage of the discharge. The values of the parameters of the discharge current and the total charges corresponding to the boundary of the current break conditions are defined for producing the maximum rate of energy dissipation in the discharge gap. 11 Refs.

Primary Keywords: Exploding Wire; Underwater Explosions; Empirical Equations; Peak Voltage Calculation; Minimum Arc Current Calculation

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7082
(INSULATION, MATERIAL)
(Solid)
ELECTRICAL CONDUCTIVITY OF DIELECTRICS IN STRONG SHOCK WAVES

A.A. Brish, E.S. Tsvetkov and V.A. Sivchenko
Soviet Physics JEPT, Vol. 31, No. 1, p. 15-17 (01/1960).
Trans. From: *Zhurnal Fizicheskoi Mekhaniki i Teoreticheskoi Fiziki* 18, 22-25 (January 1960).

The electrical conductivity of air, water, and certain solid dielectrics subjected to strong shock waves has been measured. The electrical contact method. The measured values of the specific conductivity in the shock front are as follows: air, 0.5 ohm cm; water, 0.2 ohm cm; at shock front pressure $p = 1$ bar, suppose to 10¹² kbar/km. It is found that the electrical conductivity of dielectrics or paraffin reaches up to 202 ohm⁻¹ cm⁻¹, a value which approximates the conductivity of a metal. 3 Refs.

Primary Keyword: Solid Dielectric

COPYRIGHT: 1960 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7084
(BREAKDOWN STUDIES)
(Electrodes)
EROSION RATE AND PROPERTIES OF A CATHODE SPOT OF THE FIRST KIND WITH SILVER ALLOYS

A.I. Struchkov and N.L. Pravoverov
All-Union Institute, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 23, No. 11, pp 1322-1324 (11/1978).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 48, 2309-2312 (November 1978)

The erosion rate of silver alloys in the solid-solution region is governed by the electrical resistivity at the melting point. This feature explains why the erosion rate is essentially independent of the heat treatment of the alloy. Estimates of the erosion rate for high-resistivity alloys on the basis of the explosive model agree with the experimental results. The theoretical values of the erosion rate for low-resistivity alloys are twice the experimental values; the discrepancy arises because the explosive model neglects the heat removed from the current-concentration region. 10 Refs.

Primary Keywords: Cathode Spot Properties; Erosion Rate; Estimates; Explosive Model; High Thermal Conductivity; High Electrical Conductivity; Silver Alloys

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7095
(BREAKDOWN STUDIES)
(Exploding Wires)

E.V. Krivitskii and V.P. Litvinenko
Planning And Design Of Bureau Of Electrohydraulics, Nikolaev, USSR
Soviet Physics-Techical Physics, Vol. 21, No. 10, pp 1218-1221 (10/1976).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 46, 2281-2287 (October 1976)

The models which have been proposed for exploding wires are analyzed in terms of the propagation of the pulse caused by high-current pulses for various external conditions. The initial point of the explosion can be determined from superimposed simultaneous oscilloscope traces of the voltage across the test samples. The time constant (the scale time of the explosion) is governed by the properties of the wire, the rate at which energy is supplied, and the hydrodynamic characteristics of the surrounding medium. Confirmation is found for the suggestion that the loss of metallic conductivity is due to processes which occur simultaneously throughout the wire volume. 21 Refs.

Primary Keywords: Exploding Wire; Initial Point Of Explosions; Time Constant; Wire Geometry; Environment Considerations; Theory

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7086
(PARTICLE BEAMS; ELECTRON; BREAKDOWN STUDIES)
(Generation; Exploding Wires)

EXPLOSIVE ELECTRON EMISSION AND EXPLODING WIRES

M.M. Martynuk
Patrice Lumumba University of International Friendship, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 23, No. 7, pp 837-844 (07/1978).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 48, 1482-1493 (July 1978)

The role played by explosive boiling (phase explosion) of a liquid metal in exploding wires and exploding sharp metal points is studied. If the pulse length $t_{\text{sub}} \approx 10^{-7} - 10^{-5}$ sec, the explosion is governed by the stationary homogeneous nucleation of vapor nuclei (stationary phase explosion). If the pulse length $t_{\text{sub}} \approx 10^{-8}$ sec, the process is not stationary. Data on exploding wires are used to calculate the temperature and the current density in the thermionic emission from several metals at the beginning of the stationary phase explosion. The effect of the electric field on the thermionic emission is taken into account. At the initial stage in the electrical explosion of a sharp metal tip the field emission dominates, giving way to explosive emission of electrons. The current rise in the initial stage of explosive emission is due to the rapid increase in the emitting surface area in the explosive formation of a finely dispersed vapor-liquid mixture. The decomposition of this thermodynamically unstable phase may play a role in the nonstationary electric explosion of sharp metal points and in exploding wires. The results are extended to temperature, current density, and radius of the exploding cathode in a vacuum arc. 33 Refs.

Primary Keywords: Explosive Electron Emission; Exploding Wires; Long Pulse Length; Stationary Process; Short Pulse Length; Non-stationary Process; Theory

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7088
(POWER CONDITIONING; POWER CONDITIONING)

TRANSFORMERS; FORMATION AND PROPAGATION OF ELECTROMAGNETIC SHOCK WAVES IN TRANSMISSION LINES CONTAINING UNSATURATED FERRITE

L.A. Petrovskii
Soviet Physics-Techical Physics, Vol. 8, No. 9, pp 805-813 (03/1964).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 33, 1080-1092 (September 1963).

A discussion is given of the nonlinear phenomena observed in transmission lines containing a ferrite, in which the remagnetization takes place incoherently. A study is made of the dissipative mechanism of shock wave formation, as well as the development of strong discontinuities. 10 Refs.

Primary Keywords: Unsaturated Ferrite; Nonlinear Phenomena; Transmission Lines; Remagnetization; Electromagnetic Shock Wave Formation; Magnetic Field Rate Of Change

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7089

(PULSE GENERATORS; SWITCHES; CLOSING; SWITCHES; OPENING)
 (Capacitor Banks; Gas Gaps; Electrical; Gas Gaps; Magnetic Field)
 A GENERATOR THAT PRODUCES POWERFUL PULSES USING GAS-DISCHARGE
 COMBINATIONS OF THE TRIOTRON AND TRIDPLASMAHOTRON TYPE
 A.I. Vishnevskii, A.N. Kuz'michev, V.I. Krishenovskii, A.I. Soldatenko
 Kiev Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1417-1419
 (10/1973). Trans. From: *Fizika i Tekhnika Eksperimenta* 5, 104-106
 (September-October 1973)

The possibility of creating a pulse generator (modulator) with partial discharge of the storage device using gas-discharge devices having a cold cathode and two-way control (triotrons and triplasmotrons) is demonstrated. The ignition of the discharge in the devices takes place when a positive pulse is applied to the control electrode. Extinction occurs when the magnetic field is reduced below a critical value. The generator operates in a steady-state mode at voltages of up to 15 kV and allows current pulses of up to 300 A to be obtained with smooth control of their length in the 10 to 150 microsecond range. 6 Refs.

Primary Keywords: Pulse Generator; Triotron; Gas Switch; Magnetic Field; Convex Geometry; Partial Space Discharge

COPYRIGHT: 1974 PLENUM PRESS. REPRINTED WITH PERMISSION

7090

(BREAKDOWN STUDIES; SWITCHES; CLOSING)
 (Vacuum; Electrons; Vacuum Gaps; E-beam)
 INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM BY AN ELECTRON BEAM
 N.V. Belov, E.V. Ostrovskii, V.F. Gaidukov, I.V. Streikov and L.N. Kolesnikov
Soviet Physics-Technical Physics, Vol. 16, No. 3, pp 436-438 (09/1971). Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 35, 563-566 (March 1971). A system has been investigated for initiating a discharge in high vacuum by an electron beam. The dependence of breakdown delay time on electron-beam parameters is presented. It is shown that the breakdown time is associated with a specific temperature in the region of the anode bombarded by the electrons. 7 Refs.

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7091

(BREAKDOWN STUDIES)
 (Exploding Wires)
 MHD CALCULATION FOR EXPLODING WIRES
 Yu.D. Bakulin, V.F. Kuroptenko and A.V. Luchinskii
Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1144-1147 (09/1976). Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 46, 1963-1969 (September 1976). A method of analyzing electric circuits with exploding wires is presented. This MHD analysis describes the entire explosion of copper wires with an accuracy suitable for practical purposes. The conductivity of copper is found as a function of the density and specific thermal energy by a method based on theory and experiment. The calculations use an equation of state for the metal which takes the evaporation of the metal into account. Calculated results are given, and compared with experimental data. 11 Refs.

Primary Keywords: Exploding Wires; Copper Wires; MHD Analysis; Copper Conductivity; Equation Of State; Theory

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7092

(BREAKDOWN STUDIES)
 (Liquid; Electrical)
 PREDISCHARGE PHENOMENA IN LIQUIDS
 L.E. Selygin
Soviet Physics JETP, Vol. 3, No. 3, pp 355-361 (10/1956). Trans. From: *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* 30, 464-470 (March 1956). The results of an investigation of prebreakdown phenomena in transformer oil, castor oil, xylene and distilled water are presented. At voltages sufficient for breakdown, it is shown that ionization by collision occurs during the statistical delay period, resulting, in a time of approximately 10-8 sec, in the production of electron avalanches and small streamers. In liquids not able to lead to cumulative breakdown, but with a low dielectric strength, it has been established that breakdown voltage for the streamer is greater than 3×10^{-5} A. It is also shown that in a streamer with high ionization rates, within the breakdown mechanism depends on the polarity of the voltage. The lifetime of the streamer with a very small radius is formed in about 5-6 sec. 15 Refs.

Primary Keywords: Liquid Breakdown; Pre-breakdown Phenomena; Collision Theory; Dielectric Strength; Dielectric Relaxation; Dielectric Constant; Avalanche; Ionization; Water; Transformer Oil; Xylene

COPYRIGHT: 1956 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7093

(BREAKDOWN STUDIES; SWITCHES; CLOSING)
 (Vacuum; Electrical; Vacuum Gaps; Electrical)
 SPECTROSCOPIC STUDY OF A CONTROLLED DISCHARGE IN A HIGH-VOLTAGE VACUUM SWITCH
 G.S. Kircheva and M.L. Cherkal'ko
 M.I. Klinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 10, pp 1704-1707 (04/1972). Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 61, 2151-2155 (October 1971). Spectral methods have been used to study effects due to the materials used in the elements of a controlled high-voltage switch (cathode, anode, triggering systems, and insulating wall) at an initial pressure of up to 10⁻¹⁰ Torr in the working chamber. A nonperiodic (0.15-1.5 microseconds) current at 1-7 kA is used. The emission spectra are studied in the gas as a whole and in individual regions during the normal and discharge modes. The spectral distribution of the primary and control discharges in the insulation of the triggering system, and the insulating walls of the vacuum chamber (near the electrodes) affect the discharge. The rise time of a controlled gap is due to propagation of plasma jet from the ignition region. 7 Refs.

Primary Keywords: Vacuum Breakdown; Triggered Vacuum Gap; Spectroscopic Diagnostic; Severe Electrodynamics; Afterglow Effects; ZIA Current

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7095

(PARTICLE BEAMS; ELECTRON)
 (Generation)

THE LIU-10 HIGH-POWER ELECTRON ACCELERATOR
 A.I. Pavlovskii, V.S. Bosemykin, V.A. Sechenko, A.P. Klement'ev, K.A. Morunov, V.S. Nikolskii, A.I. Gerasimov, V.A. Taranenkov, V.F. Basmanov, D.I. Zenkov, V.D. Sel'mir and A.S. Fedotkin
Soviet Physics Doklady, Vol. 25, No. 2, pp 120-122 (02/1980).

Trans. From: *Doklady Akademii Nauk SSSR* 250, No. 1, 18-22 (February 1980). During the past few years a new direction has been explored in the creation of high-power generation of high-current particle beams with energies of several tens of MeV linear induction accelerators (LIA) with inductors employing radial lines, which combine the possibility of variation of the acceleration energy, by varying the scale of the accelerating system, with the high current capacity associated with direct discharge of low-impedance lines with distributed parameters.

This paper gives a short description of the construction and performance of the LIU-10 accelerator. 5 Refs.

Primary Keywords: Linear Induction Accelerators; Radial Lines; Acceleration Energy Variation; High Current Capacity; LIU-10 Accelerator; Electron Flux

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7096

(POWER CONDITIONING)
 (Power Forming Lines)

THE STRUCTURE OF THE FRONT OF ELECTROMAGNETIC SHOCK WAVES IN TRANSMISSION LINES WITH NONLINEAR PARAMETERS
 A.M. Belyantsev, A.V. Gaponov and G.I. Freidman
 Radiophysical Scientific Research Institute, Gor'ki State University, USSR

Soviet Physics-Technical Physics, Vol. 10, No. 4, pp 531-539 (10/1965). Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 35, 677-689 (April 1965). The profile of an electromagnetic shock wave which propagates in a nonlinear, nondissipative medium is distorted during the propagation process. In this manner that breaks can occur in the continuity of the field vectors, and electromagnetic shock waves are generated. In exactly the same ways as in the corresponding problem of gasdynamics or magnetohydrodynamics, the presence of scatter in the solutions high-frequency region eliminates the discontinuities in the solutions which describe the electromagnetic waves in nonlinear media; in particular, it also leads to the establishment of a finite width of the shock-wave front. In the present article one-dimensional electromagnetic waves are considered in transmission lines with nonlinear parameters. Particular attention shall be paid to the relation between the structure of the shock-wave front and the scattering properties of the transmission line. 12 Refs.

Primary Keywords: Shock Front; Forming Line; Shock Wave; Dispersion; Finite Wave Theory

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7098

(SWITCHES; CLOSING)
 (Gas Gaps; Electrical)

TRANSIENT BEHAVIOR OF A HIGH-VOLTAGE LOW-PRESSURE TRIGGERED SPARK GAP
 G.S. Kicheva
 M.I. Klinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 9, pp 1552-1555 (03/1972). Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 41, 1963-1968 (September 1971).

Delay times and jitter of a triggered spark gap have been investigated at 5-50 kV and initial pressures in the range approximately 4E-5 - 6E-2 mm Hg as a function of gap size (3-36 mm), voltage polarity, triggering arrangement, and triggering current. At pressures approximately 4E-3 mm Hg and greater the triggering mechanism is associated with ionizing collisions between the residual gas and electrons from the trigger spark. At lower pressures (1E-3 - 1E-5 mm Hg) the role of the plasma jet from the ignition region increases. 13 Refs.

Primary Keywords: Triggered Spark Gap; Trigger Mechanism; Jitter Measurement; 6E-5 - 6E-2 Pressure Range; 50 kV Operating Voltage; Triggering Mechanism

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH

PERMISSION

7099

(PARTICLE BEAMS; ELECTRON)

(Generation)
 A PULSED ELECTRON BEAM ACCELERATOR 'AQUAGEN'
 A.P. Avetisov, V.T. Bocharintsev, E.L. Astrel'in, V.A. Kapitonov and V.M. Lebedev
 Institute of Nuclear Physics, Siberian Div. of the USSR Academy of Sciences, Novosibirsk, USSR

1976 IEEE Pulsed Power Conference Proceedings, Paper III-E-11 (11/1976). The accelerator 'Aquagen' is designed for producing the pulsed electron beam with a current of 400 kA, an electron energy of 1.2 MeV for 60 ns. The expected total beam energy is about 10 to 15 kJ. The accelerator will be used for plasma heating by relativistic electron beam in the model experiments on the 'Kase' plasma confinement in the multiple mirror device 'T-11'. 20 Refs.

Primary Keywords: Aquagen Accelerator; High Current; High Energy; High Dielectric; Numerical Calculation; Field Calculation

Secondary Keywords: Plasma Heating

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

7100

(PULSE GENERATORS; SWITCHES; CLOSING)

(Trigger; Taciitrons)
 A PULSE GENERATOR BASED ON TACITRONS
 V.D. Dvornikov, S.I. Letuchkin, L.I. Yudin and V.M. Komarov
 Atomic Energy Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 455-458 (04/1975). Trans. From: *Fizika i Tekhnika Eksperimenta* 2, 107-110 (March-April 1975).

A circuit is presented for shaping voltage pulses across a distant capacitive load of approximately 70 pF using industrial TGU1-5/12 taciitrons as the commutating elements. The output pulses have an amplitude of 20 kV at a rectifier voltage of 3 kV, and a length of approximately 70 nsec for a leading-edge duration not exceeding 35 nsec. The instability of the delay of the output pulses relative to the pulses at the input of the taciitrons is approximately 1 nsec. The repetition frequency of the pulses is 120 kHz. 8 Refs.

Primary Keywords: Pulse Generator; Taciitron Switch; 20 kV Output Voltage; 20 nsec Pulse Length; 1 ns Jitter

COPYRIGHT: 1975 PLENUM PRESS. REPRINTED WITH PERMISSION

7101
(POWER CONDITIONING)
(Pulse Forming Networks)
A SHAPER THAT PRODUCES SHORT PULSES ACROSS A CAPACITIVE LOAD
L.Z. Gogolitsyn
Leningrad Electrical Engineering Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1350-1351
(10/1974).
Trans. From: Pribyly i Tekhnika Eksperimentov 5, 93-94
(September-October 1974)

The circuit of a shaper is considered that produces pulses across a capacitive load and whose circuit includes an additional capacitor and resistor which permit the shaping of pulses with a length shorter than the time required to restore the controlling properties of the commutating instrument. 3 Refs.
Primary Keywords: Pulse Shaping Circuit; Rectangular Pulse; Capacitive Load; Short Pulse; Switch Recovery
COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

7104
(ENERGY STORAGE, INDUCTIVE)
(Inductors)
CALCULATION OF TOROIDAL INDUCTIVE ACCUMULATORS WITH A D-CROSS SECTION
FROM PARAMETERS OF A DISCHARGE PULSE AND OF THE CHARGING DEVICE
I.A. Ivanyov, V.V. Sizov and V.A. Trukhin
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 18, No. 6, pp
473-479 (08/1977).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 18,
55-61 (July-August 1977)

One method of increasing the power of the discharge pulse of an inductive accumulator is based on the use of a scheme with a switch-over. With charging, the sections of the accumulator are connected in series and with discharge, in parallel. In this case, certain requirements are imposed on the symmetry of the cross section. Such requirements are satisfied by constructions with a toroidal field (another of their advantages is the absence of scattering fields). The internal rectilinear cross section of the coil is subject to compression in the direction of the principal axis and to longitudinal elongation. In a construction with such a profile, with uniform equalization of the radial compression, the action of the bending moments is everywhere completely excluded. The form of the profile, with which the winding does not undergo the action of the bending moments, is called a D-section. A construction with a D-section is optimal with respect to energy capacity. Therefore, in comparison with other variants of toroidal constructions in coils with a D-section, the specific parameters are found to be the highest. 2 Refs.

Primary Keywords: Toroidal Inductive Accumulators; D-cross Section; Discharge Pulse; Toroidal Field; Optimal Mechanical Strength; Optimal Energy Capacity
COPYRIGHT: 1978 PLENUM PRESS, REPRINTED WITH PERMISSION

7105
(POWER CONDITIONING)
(Pulse Transformers)
CO/SUB 2/ LASER HIGH-VOLTAGE POWER SUPPLY BASED ON A PULSED AUTOTRANSFORMER

V.V. Apollonov, A.I. Berchukov, S.I. Derzhavin, I.G. Kononov, K.N. Firsov, Yu.A. Shakir, V.A. Yamashchikov, A.V. Krivonenko, S.S. Pel'tsman and B.V. Saakin
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, Vol. 21, No. 6, pp 1602-1604
(12/1978).
Trans. From: Pribyly i Tekhnika Eksperimentov 6, 131-133
(November-December 1978)

We describe the construction of a high-voltage system with a pulsed autotransformer for the supply of a CO₂ laser with a transverse discharge. The system parameters are U₀/sub max/ = 150 kV, I₀/sub max/ = 20 kA, and the length of the discharge current T₀/sub 0/ = 1 microsecond. Several models were tested, with different cross sections, transformation coefficients, and numbers of turns in the windings. Stable glow discharges were obtained in gas mixtures CO₂/sub 2/; N₂/sub 2/; He = 1:2:3, 1:2:2, 1:2:1.5 in a volume 60 mm³, a 500 nm at energy inputs up to 400 J/litter atm. 4 Refs.

Primary Keywords: Pulsed Autotransformer; Transverse Discharge, 150 kV Voltage; 20 kA Current; Maximum Energy Transfer; Efficiency; Minimum Energy Release Duration; < 10⁻⁴ Instantaneous Power; < 1 Microsecond Current Duration; < 40 J/cm² Energy Input

Secondary Keywords: CO₂/sub 2/ Laser Power Supply
COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

7106
(ELECTROMAGNETIC FIELD GENERATION)
(Magnetic)
COMPRESSION OF MAGNETIC FIELD IN AN IMPLDING SPHERICAL CA
V.K. Bodulinskii and Yu.A. Man'nev
Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 11, No. 5, pp
991-997 (12/1970).
Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 11,
114-115 (November-December 1970).

The equations describing the compression of a magnetic field, produced by a system of rotating currents, in an imploding spherical cavity are solved in the present communication. 6 Refs.
Primary Keywords: Flux Compression; Plane Parallel Conducting Surfaces; Cylindrical Geometry; Design Optimization
COPYRIGHT: 1973 PLENUM PRESS, REPRINTED WITH PERMISSION

7107
(BREAKDOWN STUDIES)
(Gas, Electrical)
CONTRACTION OF THE DECAYING PLASMA IN A NITROGEN DISCHARGE
V.Yu. Beranov, F.I. Vyshkevich, A.P. Sapartovich, V.G. Niz'ev, S.V. Pugachov and L.I. Streltsova
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Journal Of Plasma Physics, Vol. 4, No. 2, pp 201-205 (04/1978).
Trans. From: Fiz. Plazmy 4, 358-365 (March-April 1978)

The stability of a nitrogen glow discharge plasma in a static electric field has been studied. Gas-dynamic effects in the discharge gap were studied with an interferometer. Experimental results on the electrode effects in pulsed discharges are reported. The discharge was photographed during the transition from the homogeneous phase to an arc, using an LV-03 time-loop unit. The experimental data on the time of this transition are compared with numerical calculations. The model used for these calculations incorporates stepwise ionization. The ionization rate is established by the electron states of the molecule and the time evolution of the gas density in the discharge gap. The rate constants for the elementary processes involving electrons are calculated with a non-Maxwellian electron velocity distribution, which is a function of E/m and the average vibrational temperature of the gas. It is concluded that the time required for the discharge contraction is very sensitive to the gas-dynamic perturbations, the stepwise ionization, and the variation of vibrational temperature of the rate constants for the elementary processes. 15 Refs.
Primary Keywords: Nitrogen Discharge; Glow Discharge; Discharge Contraction; Static Electric Field; Gas Density; Electrode Effects, Experimental Theory
COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7111
(BREAKDOWN STUDIES)
(Liquid, Electrical)
DEVELOPMENT OF A PULSE DISCHARGE IN LIQUIDS
V.S. Komel'kov
Soviet Physics-Techical Physics, Vol. 6, No. 8, pp 691-699 (02/1961).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 946-960 (August 1961)

We show experimentally that pulse discharges in polarized (distilled water) and nonpolarized (transformer oil) liquids are the result of a leader process. In a low resistance discharge circuit a stepwise movement of the leader from electrode to electrode is noted. In oil a secondary discharge takes place after the completion of the leader stage. We give a qualitative analysis of the phenomena under study. 28 Refs.

Primary Keywords: Liquid Breakdown; Water Breakdown; Transformer Oil Breakdown; Leader Process; Continuous Leader; Photographic Diagnostic
COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7113
(BREAKDOWN STUDIES)
(Liquid, Electrical)
DISCHARGE PHENOMENA IN LIQUIDS
I.S. Stekol'nikov and V.Ye. Ushakov
G.M. Kirzhnovenovskii Institute, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 10, No. 9, pp 1307-1313
(05/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1692-1700 (September 1965)

In the present work we have investigated the development of discharges in transformer oil (of GOST strength 45 to 55 KV), distilled water (gamma = 1E-5/cm²), and ethyl alcohol (industrial grade) under a pulsed voltage in rod-to-plane (-rp and -rip) and rod-to-rod (rrr) geometries. The interelectrode gap was varied from 50 to 165 mm. The voltage pulse length was varied from 1.5 to 70 microseconds at the amplitude corresponding to 50% of the discharge value. 10 Refs.

Primary Keywords: Liquid Breakdown; Water Breakdown; Transformer Oil Breakdown; Alcohol Breakdown; Rod-Rod Gap; Rod-Plane Gap; Breakdown Development; Photographic Diagnostic
COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7115
(BREAKDOWN STUDIES)
(Gas, Electrical)
GAS-DISCHARGE CONTRACTION
E.A. Muratov, I.G. Persiantsev, V.D. Pis'mennyi and A.I. Rakhimov
Nuclear Physics Scientific-Research Institute, Moscow State University,
Moscow, USSR
High Temperature, Vol. 13, No. 3, pp 592-594 (06/1975).
Trans. From: Atomizdat Vysokikh Temperatur 13, 654-656 (May-June 1975)

A diffuse gas discharge in a cylindrical tube contracts as the current increases; the degree of contraction is dependent on many detailed characteristics such as the degree of ionization, the charged particle recombination mechanism, and the electronegative impurity concentration, but the usual contraction mechanism for a long cylindrical tube is radial displacement of the heated gas from the axis towards the periphery. This is due to the radial temperature gradient, which itself arises from the surface heat loss. To establish the importance of the heating in the contraction, we made some experiments with a glass tube filled with a gas carrying a normal glow discharge, and the pressure, current, and voltage were checked at the end of the discharge along the entire cross section. Such a discharge will burn in a stable fashion if the cylinder contains a ballast resistance whose value is governed by the discharge current, and which usually has to be much greater than the plasma resistance. In that case, any current fluctuation in the plasma results in a change in the balance of potential differences between the ballast resistance and the discharge tube, which tends to stabilize the situation. 7 Refs.

Primary Keywords: Gas Discharge; Diffuse Discharge; Discharge Contraction; Current Dependence; Impurity Concentration
COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

7116
(POWER CONDITIONING)
(Pulse Transformers)
GENERALIZED CHARACTERISTICS OF THE OSCILLATORY SYSTEM OF A TUNED HIGH-VOLTAGE TRANSFORMER FOR SUPPLYING HIGH-CURRENT PULSED ACCELERATORS
S.M. Mezentsev, V.I. Mikhailov and S.V. Neek
All-Union Institute, Moscow, USSR
Instruments And Experimental Techniques, Vol. 17, No. 6, pp 1559-1562
(12/1974).
Trans. From: *Pribory i Tekhnika Eksperimenta* 6, 14-17
(November-December 1974)

Generalized characteristics are given for the coupled circuits of a tuned high-voltage transformer, which enables one to calculate the circuit parameters when there is nonlinear loading, which is typical of high-current pulsed electron accelerators. 6 Refs.

Primary Keywords: Tuned Transformer; Nonlinear Load; Electron Accelerator; Theory; Experiment; Switching Considerations

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

7117
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT PULSED ELECTRON GUN BASED ON AN ELIT-1 ACCELERATOR
V.A. Denylychev and V.E. Khodkevich
Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Instruments And Experimental Techniques, Vol. 14, No. 3, pp 110-113
(06/1971).

Trans. From: *Pribory i Tekhnika Eksperimenta* 3, 157-158 (May-June 1971).
The construction of an electron gun based on an ELIT-1 accelerator is proposed which allows pulsed electron current of up to 1 kA having a current-pulse length of 10 nsec to be obtained at an accelerating voltage of 1 MeV. 2 Refs.

Primary Keywords: Electron Gun; ELIT-1 Accelerator; <1 kA Pulsed Electron Current; 10 nsec Current-pulse Length; 1 MeV Accelerating Voltage; Insulator Dielectric Strength

COPYRIGHT: 1971 PLENUM PRESS, REPRINTED WITH PERMISSION

7120
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)
(Magnetic; Flux Compression)

MAGNETIC CUMULATION
A.D. Academician, R.Z. Sakharov, R.Z. Lyubav, E.M. Smirnov, Yu.I. Plyushchhev, A.I. Pavlovskii, V.K. Chernyshev, E.A. Fankistov, E.I. Zharinov and Yu.A. Zysin
Soviet Physics Doklady, Vol. 10, No. 11, pp 1045-1047 (05/1965).

Any explosion is an abundant source of mechanical and thermal energy. In 1951 Sakharov proposed a possible way of converting this energy to magnetic form together with the general lines of devices for producing very strong fields and currents by the explosive deformation of current-carrying conductors. The process has been called magnetic cumulation. Here we describe briefly two typical generators of this type: the MK-1 (which follows compression of an axial magnetic field) and the MK-2 (ejection of the magnetic field from a solenoid and subsequent compression by the walls of a coaxial line). 3 Refs.

Primary Keywords: Flux Compression; Magnetic Cumulation; Axial Magnetic Field Compression; Coaxial Line Wall Compression; Aluminum Tube

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7121
(PULSE GENERATORS; ENERGY STORAGE, CHEMICAL)
(Flux Compression; Flux Compression Generators)

MAGNETOIMPLOSIVE GENERATORS
A.D. Sakharov
Soviet Physics Uspekhi, Vol. 9, No. 2, pp 296-299 (10/1966).

Trans. From: *Usp. Fiz. Nauk* 88, 725-734 (April 1966).
Several recent experimental and theoretical papers are devoted to the use of explosions to produce ultrastrong magnetic fields. The same topic was also the subject of a recent international conference (Rome, September 1965). In the USA and the USSR, fields of 15-25 million gauss were attained in individual experiments. General weaker fields (15-25 million gauss) can be attained relatively simply. In this article we describe the physical and structural principles of magnetoinulsive generators and their characteristics and touch upon problems involving their application. 10 Refs.

Primary Keywords: Flux Compression Generator; Explosive Driven; Detonator; Lens; Losses; Cylindrical Symmetry; Theory

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7122
(BREAKDOWN STUDIES)
(Gas, Electrical)
ONSET AND THE IONIZATION INSTABILITY IN A PERIODIC, EXTERNALLY SUSTAINED DISCHARGE IN NITROGEN AND A N₂/CO₂/SUB 2%/MIXTURE AT HIGH PRESSURES
E.A. Mustafa, V.D. Pustynnyi and A.T. Rekhimov
Scientific-Research Institute Of Nuclear Physics, Moscow State University, Moscow, USSR
Soviet Journal of Plasma Physics, Vol. 3, No. 2, pp 230-232 (04/1977).

Trans. From: *Fiz. Plazmy* 3, 403-408 (March-April 1977).
When an externally sustained discharge is generated in a train of pulses in a high-pressure gas, the maximum specific energy which can be pumped into the gas is quite different from that in the case of single-pulse excitation. The time evolution of the instability which limits the number of pulses of homogeneous, externally sustained discharge in nitrogen is different from that in an N₂/CO₂/SUB 2% mixture. The difference is attributed to an essential difference in the instability. 9 Refs.

Primary Keywords: Gas Discharge; Hensel-sustained Discharge; Breakdown Instability; Temporal Resolution; Chang Electrodes; N₂/CO₂/SUB 2% Mixture

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7123
(BREAKDOWN STUDIES)
(Gas, Electrical)
SOME CHARACTERISTICS OF A DOUBLE, HOLLOW CATHODE WITH THE PULSED SUPPLY OF THE CATHODE-EXCITER
Yu.B. Atreshev and V.N. Muzgin
Journal of Applied Spectroscopy, Vol. 23, No. 3, pp 1153-1156 (09/1974).
Trans. From: *Zhurnal Prikladnoi Spektroskopii* 21, 414-418 (September 1974)

The use of a double, hollow cathode with separated zones for evaporation and excitation made it possible to obtain a quantity of new data on the mechanism for a discharge in hot and cooled hollow cathodes. In connection with this it was of interest to use the method of the time-dependent control of the processes for the evaporation of the anode material and for the excitation of its spectrum to study little investigated variations of the discharge in a hollow cathode at low temperatures. In this study a discharge tube was used with a double hollow cathode, analogous to that described earlier. The cathode-evaporator was supplied by means of a direct current and the cathode-exciter was supplied by a pulsed current having an amplitude of from 0.5 to 10 amps for a following frequency of the pulses of from 20 to 1000 Hz. 12 Refs.

Primary Keywords: Helium Gas Breakdown; Optical Diagnostic; Emission Spectra; Hollow Cathode; Impulse Voltage

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

7124
(SWITCHES, OPENING)
(Explosive Fuses)
SWITCHING CHARACTERISTICS OF EXPLOSIVE DISCONNECTORS WITH RAPID DESTRUCTION OF THE CONTACT ELEMENT
E.A. Azizov, N.A. Akhmerov, K.I. Kozyrev and V.V. Semchenko
Moscow, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 19, No. 4, pp 456-459 (08/1978).

Trans. From: *Zurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* 4, 46-50 (July-August 1978).

The extension of the range of application of inductive stores, including their use to obtain high-power electron beams and to supply plasma-dynamic systems with energies greater than 1 MJ, involves the design of ultra-low-resistance (approximately 10⁻⁶ ohm) switches for power levels of 1E11 - 1E12 W and switching rise times of 10⁻⁶ - 10⁻⁷ sec. It would seem that such switches can be designed using the principles of the rapid destruction of a contact element by an explosive charge. However, a number of problems arise in this direction which can only be solved experimentally: 1) What should the length of the destroyed part of the contact for a given switching voltage be, and how does it depend on the current and geometry? 2) What is the minimum switching time determined by the interaction between the current and an arc which occurs at the points of destruction? 3) The relation between the ratio of the masses of the explosive charge M_{exp} g and the contact junction m_{contact} g/M_{exp} g, and the switching power for a given thermal stability of the current-carrying elements. In this paper we present the results of a study of the switching characteristics of some versions of explosive switches (ES) with rapid destruction of the contact element. 3 Refs.

Primary Keywords: Load Circuit Characteristics And Parameters; Rapid Contact Element Destruction; Ultra-low-resistance Switches; 1E11 - 1E12 W Power Levels; 10⁻⁶ - 10⁻⁷ sec Switching Rise Times; Explosive Switches

COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

7125
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)
V.L. Budovich and I.P. Kuzhekin
Moscow Power Institute, Moscow, USSR
Soviet Technical Physics Letters, Vol. 1, No. 11, pp 440-441 (11/1975).

Trans. From: *Sov. Zhurnal Tekhnicheskoi Fiziki* 1, 1023-1026 (November 1975).
It is shown elsewhere that a conductor through which a high current flows can be destroyed by MHD instabilities. The development of such instabilities in liquid conductor leads, in the final analysis, to the formation of numerous breaks in the conductor in which electric arcs are ignited. Ignition of each arc raises the voltage across the conductor by an increment to a value not less than the sum of the voltage drops across the arcs. This effect is manifested as a step-wise rise. The number of such breaks and arcs increases rapidly, and after the first arc is ignited, the voltage across the exploding wire increases rapidly. To be able to record the steps corresponding to the ignition of arcs in the breaks, it is necessary to measure the voltage with high time resolution. The measurement has been performed here in the following manner: When current begins to flow from a 0.0156 F capacitor bank through a wire connected in series with a 0.34 ohm ballast resistor, a signal is applied to a 5G-27 generator, and this delays the pulse triggering the 58-2 oscilloscope. The delay is chosen approximately equal to the time between the start of the current flow and the very rapid growth of the voltage. 4 Refs.

Primary Keywords: Exploding Wires; Voltage Measurement; High Temporal Resolution; Voltage Step; Magnetohydrodynamic Instability; Wire Constriction

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7126
A NANOSECOND PULSE GENERATOR FOR SPARK CHAMBERS
A.I. Alikhanyan, A.S. Alekseyan, G.A. Vorob'ev, R.L. Kebabov and V.K. Krol
FIR, Wright-Patterson AFB, OH
NRL IDCRP-7-1848-9, 17p (12/1979).
Availability: AD-A087 876/9
M75

No abstract available.
Primary Keywords: Pulse Generators; Spark Chambers; Magnetic Fields; Translations: USSR
Secondary Keywords: Strip Lines; Arkad'yev Marx Generators; Coaxial To Strip Crossover; NTISDDDXA; NTISFNUR

7130
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, INDUCTIVE)
(Inductors; Systems)
AN INDUCTIVE STORE WITH ELECTROMAGNETIC CURRENT MULTIPLICATION
A.V. Ivlev, A.S. Kibardin, A.V. Komin, V.G. Kuchinskii, K.M. Lobanov
and Yu.A. Morozov
D.V. Efremov Institute, Leningrad, USSR
Electrotechnology USSR, Vol. 100, No. 1, pp 24-33 (01/1980).
Trans. From: Elektricheskoe 100, 47-49 (1980)
An inductive energy store is described in which electromagnetic current multiplication is used to increase the output current to the load without increasing pumping energy. Toroidal geometry is chosen with a circular coil utilized. A shield is imposed to alter the value of the store at an appropriate moment to increase current without elaborate switching systems. High efficiency is reported. 2 Refs.
Primary Keywords: Inductive Store; Electromagnetic Current Multiplication; 65% Efficiency; Fewer Switches; Greater Mechanical Strength; Mechanical Multiplication; Simpler Computation System; Ensured Electric Strength; Increased Metal Mass
COPYRIGHT: 1981 PERGAMON PRESS LTD.

7134
(BREAKDOWN STUDIES)
(Gas; Electrical)
DEVELOPMENT OF A SPARK DISCHARGE. I
S.I. Andreev and B.I. Drlov
Soviet Physics-Technical Physics, Vol. 10, No. 8, pp 1097-1101
(02/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1411-1418 (August 1965)
It is shown that the electrical phenomena and the expansion of a spark channel during the first current half-cycle can be described with good accuracy if it is assumed that the specific electrical conductivity of the plasma remains constant during this time interval. 16 Refs.
Primary Keywords: Spark Discharge; Constant Electrical Conductivity; Spark Channel; Channel Expansion; Power Line Frequency; Theory; Hydrodynamic Theory
COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7135
(PARTICLE BEAMS, ELECTRON)
(Generation)
DEVELOPMENT OF HIGH-CURRENT ELECTRON ACCELERATORS
M.V. Babkin and A.V. Bartov
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
Soviet Technical Physics Letters, Vol. 1, No. 3, pp 123-124 (03/1975).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 1, 257-262 (March 1975)
To realize the suggestions advanced by Zvezinskii, Winterberg, and others of initiating thermonuclear reactions by heating a dense plasma with a beam of relativistic electrons using inertial confinement, the power required is 1E15-1E16 W. When a heavy target is used to compress the target, the power is approximately 3E14 W, the beam current is 1 E17-1E18 A, and the heating time is approximately 10 nsec. When the voltage pulse used to accelerate the electrons is shaped by a transmission line, the power P , and the total line current I , are determined by the allowable field E in the dielectric and by the dimensions of the line. To obtain large power it is necessary to use large and expensive systems and optimization is important. 11 Refs.
Primary Keywords: Electron Accelerators; Relativistic Electrons; Multiple Breakdown; 5 nsec Rise Time; Cylindrical Line
COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7136
(INSULATION, MATERIAL; INSULATION, MATERIAL)
(Liquid; Solid)
DIELECTRIC MATERIALS FOR HIGH-VOLTAGE PULSE GENERATORS
B.A. Demidov, V.A. Petrov and S.D. Fanchenko
Soviet Physics-Technical Physics, Vol. 17, No. 1, pp 124-126 (07/1972).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 177-181 (January 1972).
Experiments carried out to study the electric strength E_{max} of transformer oil, distilled water, and polyethylene show 250-kV pulses 0.31 microsecond long are described. The dielectric materials are compared on the basis of the parameter causing a ϵ_0 epsilon \times electric strength E_{max} which characterizes the no. energy flux per unit cross section of the dielectric. 6 Refs.
Primary Keywords: Transformer Oil; Distilled Water; Polyethylene; Dielectric Strength; Impulse Voltage
COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7138
(PULSE GENERATORS)
(Flux Compression)
A COHERENT-MAGNETIC GENERATOR WITH AN INDUCTIVE LOAD
I.I. Dianov, G.U. Gus'kov, N.I. Zotov, O.P. Karpov and B.D. Khrustal'yev
Institute Of Earth Physics, Academy of Sciences of the USSR
Combustion Explosion and Shock Waves, Vol. 12, No. 6, pp 841-843
(12/1976).
Trans. From: Fizika Goreniya i Vzryva 12, 959-962 (November-December 1976).
The authors describe a design for an explosively driven magnetic flux compression generator driving an inductive load through a transformer. Performance data are presented with conversion efficiency included. The very flux Φ encountered is discussed. A qualitative analysis of the coupling transformer is given. 6 Refs.
Primary Keywords: Flux Compression Generator; Explosively Driven Transformer Coupling; Inductive Load; Conversion Efficiency
COPYRIGHT: 1976 PLENUM PUBLISHING CORP.. REPRINTED WITH PERMISSION

7142
(PARTICLE BEAMS, ELECTRON)
(Generation)
HIGH-CURRENT, MICROSECOND-RANGE RELATIVISTIC ELECTRON BEAM
B.A. Demidov, M.V. Ivkin, V.A. Petrov and S.D. Fanchenko
Soviet Physics-Technical Physics, Vol. 20, No. 12, pp 1597-1608
(06/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 2568-2573 (December 1975).
An experimental study is reported of the possibility of producing a microsecond, kiloamperes pulse of relativistic electrons in an accelerator with a gap consisting of a point cathode and a plane anode. Because of the radial beam divergence in this configuration, the electron current density near the anode is reduced. This reduction makes it possible to prolong the spontaneous breakdown of the accelerating gap. The spectrum of accelerated electrons is studied. The absolute energy calibration is carried out with a beta source. 7 Refs.
Primary Keywords: Delayed Accelerating Gap Breakdown; 1 MV Pulse; Voltage Generator; Accelerating Tube; Relativistic Electron Beam; Microsecond Kiloamperes Pulse; Electron Current Density Reduction; Inhomogeneous Magnetic Field
Secondary Keywords: Radial Beam Divergence
COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7145
(ENERGY STORAGE, INDUCTIVE; ENERGY STORAGE, CAPACITIVE)
(Systems; Capacitor Banks)
INDUCTIVE STORAGE BANK FOR DYE-LASER PUMPING
I.I. Artem'yanov, B.A. Barikhan, V.V. Borovkov and V.I. Kashintsev
Soviet Physics-Technical Physics Letters, Vol. 4, No. 12, pp 573 (12/1978).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 4, 1416-1418 (December 1978).
In this letter we describe an experimental study of the pumping of an ethylene system by the dye Rhodamine 6G. The experiments are carried out in a system in which energy is supplied to the discharge in a coaxial flash lamp in two ways: direct from the capacitive storage bank, or by transfer of the energy stored in the capacitor bank to an inductance. In the second case the same amount of energy as in the first case is then transferred from the inductance to the flash lamp with no change in the parameters of the discharge circuit. 5 Refs.
Primary Keywords: Inductive Energy Storage; Increased Laser Output Energy; Comparison With Capacitive Storage
Secondary Keywords: Dye-laser Pumping
COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7146
(SWITCHES, OPENING)
(Mechanical)
INFLUENCE OF A DIELECTRIC MEDIUM ON THE CHARACTERISTICS OF A HIGH-SPEED EXPLOSIVE CIRCUIT BREAKER
E.A. Azizov, N.A. Akhmerov and V.A. Yagnov
Soviet Technical Physics Letters, Vol. 2, No. 4, pp 121-123 (04/1976).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 2, 316-321 (April 1976).
In an explosive circuit breaker that uses shunting of the disconnect arc, the section of the current conductor is destroyed with an explosive. The destroyed section is a hollow cylinder, along the axis of which the explosive charge is located. The space between the charge and the wall of the destroyed element is filled with air. 1 Ref.
Primary Keywords: Explosive Circuit Breaker; Mechanical Spreading; Current Conductor; Dielectric Medium Influence; Plasma Pressure
COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7150
(BREAKDOWN STUDIES)
(Vacuum; Electrical)
POSITION OF THE CATHODE SPOT OF A VACUUM ARC
V.A. Menchinskii
All-Union Institute, Moscow, USSR
Soviet Physics-Journal of Physics, Vol. 24, No. 7, pp 767-771 (07/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 1379-1385 (July 1979).
A mechanism is proposed for explaining the motion of the cathode spot of a vacuum arc. The spot velocities estimated on the basis of this mechanism agree with the experimental results for spots on tungsten, copper, and mercury. 22 Refs.
Primary Keywords: Vacuum Arc; Cathode Spot; Spot Motion; Theory; Comparison With Experiment; Several Cathode Materials
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7154
(PARTICLE BEAMS, ELECTRON)
(Generation)
OBTAINING HEAVY CURRENT ELECTRON BEAMS (SURVEY)
V.P. Smirnov
Instruments And Experimental Techniques, Vol. 20, No. 2, pp 337-364 (04/1977).
Trans. From: Priroby i Tekhnika Ekspertimenta 2, 7-31 (March-April 1977).
The most important results of the development of heavy current accelerating with ≥ 10 kA current and ≤ 100 nsec pulse duration are collected in this survey and their main elements: the pulse supply sources based on capacitive storage, the shaping line dielectrics, the shaping and transport lines, the shaping line commutators, the inductive storage, the accelerator tube insulators, and the diodes, are described. Certain possible accelerator schemes with energy storage in a ≥ 1 MJ beam and the power approximately 1E14 W were considered. 160 Refs.
Primary Keywords: 10 kA Heavy Current Accelerators; ≤ 100 nsec Pulse Duration; 1E13 W Maximum Beam Power; 2 Ms Beam Energy; Relativistic Electron Beam
COPYRIGHT: 1977 PLENUM PRESS. REPRINTED WITH PERMISSION

**7158
(PARTICLE BEAMS, ELECTRON; BREAKDOWN STUDIES)**

(Generation; Vacuum, Electrical)
PREPULSE DISCHARGES IN THE DIODES OF A HIGH-CURRENT ACCELERATOR WITH A DOUBLE SHAPING LINE
V.A. Tsukerman, I.A. Troshkin, K.F. Zelenskiy and N.V. Boikin,
Soviet Technical Physics Letters, Vol. 5, No. 2, pp 67-68 (02/1979).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 5, 169-172 (February 1979).

High-current accelerators with vacuum diodes with double shaping lines have recently been adopted widely for generating short pulses of relativistic electrons and bremsstrahlung. Such lines are usually charged with a pulsed Marx system. During charging a preliminary high-voltage pulse appears across the electrodes of the vacuum diode. We have found the prepulse useful in a comparatively small high-current generator of fast electrons and bremsstrahlung, the GONG generator. 3 Refs.

Primary Keywords: E-beam Generator; Prepulse Discharges; High-current Accelerator; Double Shaping Line; Vacuum Diodes; GONG Generator.

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**7159
(PULSE CURRENT GENERATOR)**

M.I. Kozlov and N.S. Rudenko
FTD, Wright-Patterson AFB, OH
No. FTD-ID(FPS)-1936-79, 8p (12/1979).
Availability: AD-A084 534-7
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Electric Generators; High Voltage, Patents; Translations
Secondary Keywords: Foreign Technology; NTISDODXA; NTISFNUR

**7160
(SWITCHES, CLOSING)
(Surface Discharge, Electrical)**

TIME CHARACTERISTICS OF A MULTICHANNEL GRAZING-DISCHARGE HIGH-VOLTAGE SWITCH

G.I. Belyaev, P.N. Dashuk and M.A. Chernov
M.I. Kalinin Leningrad Polytechnical Institut., Leningrad, USSR
Soviet Physics-Techical Physics, Vol. 24, No. 5, pp 578-581 (05/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 980-986 (May 1979).

The temporal characteristics of multichannel grazing-discharge switches consisting of several parallel channels and currents up to 1E6 A have been tested experimentally. Short delay times and switching times are found (1E-7 sec). In addition, the spread in these times is small (1E-8 sec). The characteristics of the ignition device and the magnitude and polarity of the main voltage affect the controllability of the switch. 9 Refs.

Primary Keywords: Multichannel Grazing-discharge Switches; 1E6 A Currents; Short Delay Times; Fast Rise Time; Low Inductance

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**7161
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)**

TWO-CHAMBER HEAVY-CURRENT HIGH-VOLTAGE SWITCH
O.G. Bespalov, A.S. Kryzeyatov, A.I. Nastiyukha, P.A. Smirnov and A.N. Udevonko
Instruments And Experimental Techniques, Vol. 18, No. 1, pp 125-126 (02/1975).
Trans. From: Pribyt i Tekhnika Eksperimenta 1, 113-114 (January/February 1975).

A description is given of a switch that will handle currents of about 500 kA at 1-20 kV with a length of 5-100 microseconds for the first half-cycle in the pulse and a repetition frequency of 0.1 Hz. The device works with residual gas at 3-8E-2 Torr. A study has been made of the gas composition. 5 Refs.

Primary Keywords: 1-20 kV Switch; 500 kA Currents; Hollow Cold Cathode Arc Switches; Two Chamber Switch; Copper Anode

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

**7162
(BREAKDOWN STUDIES)**

(Vacuum, E-beam)

VAPOR PRESSURE AND LOCAL ANODE TEMPERATURE IN ELECTRICAL BREAKDOWN IN VACUUM BY AN ELEC RAY BEAM

V.I. Mikhailov and M.I. Kir'yov
Soviet Physics-Techical Physics, Vol. 15, No. 1, pp 169-170 (07/1970).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 10, 216-217 (January 1970).

Electrical breakdown in vacuum can result from local heating of the anode. The anode is heated by an artificially produced beam of electrons. The increment of electron current in the gap is measured after the vapor pressure of material from the stainless steel anode, n/sup 0.5/E19, cm/sup 0.5/, is determined. A local anode temperature is approximately 1E6-1E20 K. Data are calculated from other experimental parameters. The order of magnitude of the values is close to that obtained in other work. 6 Refs.

Primary Keywords: E-beam Initiated Electrical Breakdown; Vacuum Breakdown; 3100-3200 Deg K. Local Anode Temperature; Anode Material Evaporation; 1E19 cu.cm. Evaporation Vapor Density

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**7163
(SWITCHES, CLOSING)**

(Gas Gaps, Electrical)

A SIMULATION APPROACH TO HIGH AVERAGE POWER REPETITIVELY PULSED SWITCH TESTING

R.W. Clark
Maxwell Labs Inc, San Diego, CA 92123
IEEE Transactions on Industrial Electronics and Control
Instrumentation, Vol. IECI-23, No. 1, pp 98-101 (02/1976).

A technique is discussed which can be used to simulate the very high average power environment encountered when high power switches are operated in a repetitively pulsed mode. An operational test facility is described which has been used to test spark gap switches at voltages up to 80 kV, pulse repetition rates up to 500 pps, and simulated average power levels of several megawatts. The power consumed in the test facility depends on the power simulated and the voltages used in the test circuit. Typically, the electrical duty experienced by a switch transferring several megawatts average power using a simulation content described here. 4 Refs.

Primary Keywords: Spark Gap Simulation; Low Power Operation; High Power Simulation; Replicated

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

**7164
(BREAKDOWN STUDIES)**

(Gas, Electrical)

A MODEL FOR THE STUDY OF SWITCHING-SURGE BREAKDOWN OF LONG AIR GAPS
E.J. Los
General Electric Co, Pittsfield, MA 01201
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-97, No. 6, pp 2382-2392 (12/1978).

A model of the discharge process leading to the switching surge via hover of long air gaps is presented. This model is based on a new non-thermal equilibrium model of the discharge channel. Depending on temperature and voltage, the voltage-dependent characteristics of the discharge channel simulation behave either like a resistor or a zener diode. This channel simulation is combined with an electric field calculation to produce a breakdown model for arbitrary gap geometrics and applied voltage waveforms. The model is currently implemented on a minicomputer system. 36 Refs.

Primary Keywords: Non-thermal Equilibrium Model; Discharge Channel; Resistor Behavior; Zener Diode Behavior; Arbitrary Gap Geometries; Arbitrary Voltage Waveform

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

**7165
(DIAGNOSTICS AND INSTRUMENTATION)**

(Miscellaneous)
A DOUBLE FREQUENCY METHOD FOR THE DETERMINATION OF THE VOLTAGE DEPENDENT CAPACITANCE VARIATION OF COMPRESSED GAS CAPACITORS

J. Zinkernagel
Physikalisch Technische Bundesanstalt, Braunschweig, FRG
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-98, No. 1, pp 304-309 (02/1979).

This paper describes the development of a double frequency measurement method by the aid of which the voltage dependent capacitance variation of high voltage compressed gas capacitors is determined with most methodical exactitude. The measurement method makes use of a modified Schering-bridge and of a specially developed turning device for bridge balancing, the selectivity of which is extremely high, and now in the range of low frequency measurement technique. 6 Refs.

Primary Keywords: Compressed Gas Capacitor; Schering-bridge; Very High Selectivity; Double Frequency; Electrostatic Force

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

**7166
(SWITCHES, OPENING)**

(Mechanical)

THE TRANSIENT RECOVERY VOLTAGE APPLICATION OF POWER CIRCUIT BREAKERS
R.G. Colcinaer
University of Pittsburgh, Pittsburgh PA

IEEE Transactions On Power Apparatus And Systems, Vol. 91, No. 5, pp 1961-1967 (10/1972).

The proposed transient recovery voltage standard for high voltage circuit breakers will specify application requirements on recovery voltage basis. This paper studies the influence of circuit parameters required to generate the required TRV envelope. An amplified application procedure is developed based on miles to the first line discontinuity and the number of lines connected on the bus side of the circuit breaker. 12 Refs.

Primary Keywords: Transient Recovery Voltage; Standard; Application; Current Rating; Voltage Rating

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**7167
(PULSE GENERATORS)**

(Plumbeum Lines)

'74 USE OF A PLANAR THREE-ELECTRODE PLUMBEUM LINE FOR THE SUPPLY OF SYMMETRIC STREAMER CHAMBERS

V.A. Mikhaylov and T.A. Iomadze
Institute of Physics, Academy of Sciences of the Georgian SSR,
Tbilisi, USSR

Nuclear Instruments And Methods 130, No 61-63 (08/1975).

The paper suggests a principally new supply circuit of the symmetric streamer chamber, applicable for the supply of the multilayer system of the spark gaps by a s.e.r. down voltage as well.

The photos of the chamber registered in the chamber having the sens./vol. volume (100 x 75 x 10) x 2 sq. cm. are given. 4 Refs.

Primary Keywords: Plumbeum Line; Double Forming Line

COPYRIGHT: 1975 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

**7168
(REVIEWS AND CONFERENCES)**

(Conferences)

IEEE 2ND INTERNATIONAL PULSED POWER CONFERENCE DIGEST OF TECHNICAL PAPERS

A.H. Guenther (1) and M. Kristiansen Eds (2)

(1) AFWL, Kirtland AFB, NM 87117

(2) Texas Tech University, Lubbock, TX 79409 (05/1979).

This conference record contains 105 papers (4 are included as abstracts only), 102 of which are referenced individually in the bibliography. Topics include energy storage, pulse generation, pulse shaping, switching, particle beam generation and transport, applications, and reviews of the state-of-the-art. 0 Refs.

Primary Keywords: Energy Storage; Pulse Generation; Pulse Shaping; Switching; Particle Beam Generation And Transport; Applications

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7174
(PARTICLE BEAMS, ELECTRON)
(Generation)

SIMULATIONS OF INTENSE RELATIVISTIC ELECTRON BEAM GENERATION BY FOILLESS DIODES

M.E. Jones and L.E. Thode
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 68-71
(06/1979).

Foilless diodes used to produce intense annular relativistic electron beams have been simulated using the timer-dependent two-dimensional particle-in-cell code CCUBE. Current densities exceeding 200 MA/sq.cm. have been obtained in the simulations of a 5 May 35 ohm diode. Many applications, including microwave generation, collective ion acceleration and high-density plasma heating require a laminar electron flow in the beams. The simulation results indicate that foilless diodes immersed in a strong external magnetic field can achieve such a flow. Diodes using technologically achievable magnetic field strengths (approximately 100 kG) and proper electrode shaping appear to be able to produce beams with an angular scatter of less than 35 mrad at the current densities and energies mentioned above. Scaling of the impedance and temperature of the beam as a function of geometry, magnetic field strengths and voltage is presented. 11 Refs.

Primary Keywords: Annular E-beam; High Impedance; Laminar Flow; Good Collimation; Numerical Calculation

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7175
(ENERGY STORAGE, MECHANICAL; PULSE GENERATORS)
(Rotating Machines; Rotating Machines)

FUNDAMENTAL LIMITATIONS AND DESIGN CONSIDERATIONS FOR COMPENSATED PULSED ALTERNATORS

W.F. Woldom, W.L. Bird, M.D. Driga, K.M. Tolik, H.G. Rylander and H.H. Woodson
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 76-87
(06/1979).

Since the beginning of a project intended to demonstrate the feasibility of using a compensated pulsed alternator (compensator) as a power supply for NOVA and other solid state laser systems, a great deal of interest has been generated in applying this type of machine to supply energy for other types of loads. This paper outlines the fundamental limitations imposed on the design of such a machine by the mechanical, thermal, magnetic, and electrical properties of the materials used. Using these limitations, the power and energy available from the machine are calculated as functions of machine dimensions. Several configurations for the machine and their relative merits for various applications are also discussed. 5 Refs.

Primary Keywords: Compensator; Limitations; Pulse Transformer; Load Coupling; Pulse Width Determination

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7176
(ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)

COMMAND CHARGE USING SATURABLE INDUCTORS

S. Black and T.R. Burkes
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 102-105
(06/1979).

Line-type pulsers operating at re-rate greater than a few kilohertz require special circuits to insure proper operation of the switch. Specifically, thyratrons and other closing switches require a 'grace period' of several microseconds or more before anode voltage is repelled; this delay allows recovery and prevents reclosure of the thyratron. One method of achieving the required delay time is by using a slightly mismatched FFM and slower-than-resonant charging. However, repetition rates of line-type modulators are limited by the characteristic of resonant charging. In order to increase repetition rate characteristics may be modified by using a saturable reactor as a storage inductor. This paper describes design considerations and laboratory performance of saturable inductors used to resonantly charge an energy storage network up to 25 kV with a delay as much as 16.5 microseconds. 1 Refs.

Primary Keywords: Saturable Reactor; Charging Inductor; Line-type

Pulser; Repetition; Thyratron

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7177
(BREAKDOWN STUDIES)

(Surface Flashover)

INVESTIGATIONS OF FAST INSULATOR SURFACE FLASHOVER

J.E. Thompson (1), L.W. Lin (1), K. Mikkelson (2) and M. Kristiansen (2)
(1) University of South Carolina, Columbia, SC
(2) Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 106-112
(06/1979).

Electric optical measurements of the electric fields along insulator surfaces have been made to determine the mechanisms associated with fast insulator flashover. Data will be presented that show the temporal and spatial performance of the surface fields prior to and at flashover for insulator surfaces oriented at 0 Deg. and 3 Deg. with respect to the applied field. Results show that the surface field near the cathode is enhanced and the field near the anode is reduced during the excitation. The results further show a temporal reduction in the field non-uniformity as flashover is approached. The final collapse for 45 Deg. surfaces begins at the anode and propagates at 0.83 cm/s towards the cathode. Mechanisms consistent with these experimental measurements will be postulated. 10 Refs.

Primary Keywords: Electro-optical Measurements; Surface Field Profiles;

Temporal Field Profiles; Field Collapse

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7178
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Electrical; Gas Gaps, Self)

BREAKDOWN IN SMALL FLOWING GAS SPARK GAPS

W.K. Cary Jr., D.D. Lindberg and J.W. Rice
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, pp 114-118
(06/1979).

An improved method for studying electrical breakdown in small, flowing gas spark gaps is described. The apparatus and data processing yield the time to breakdown, current, resistance, power dissipation and energy loss in the spark gap during the 4 ns in which the current rises from zero to a near constant value. A specially constructed transmission line terminated in a spark gap and instrumented with a B-dot probe and sampling oscilloscope is used to observe the breakdown. The initial charge on the transmission line and the current, obtained by integrating the B-dot signal, provide the information needed to define the spark gap characteristics well characterized over a range of 100 to 1000 V/cm. With temporal resolution better than 5 ps, current components with frequencies to 10 GHz could be measured. An electronic circuit held the gap breakdown voltage and the subsequent charge in the transmission line to precise, predetermined values. A computer based data reduction system determined the current waveform from data corrected for the frequency response of the signal delay line. Results are given for argon and nitrogen, both at two overvoltages. 5 Refs.

Primary Keywords: Time to Breakdown; Current; Resistance; Power Dissipation; B-dot Probe; Transmission Line Spark Gap

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7179
(BREAKDOWN STUDIES)

(Liquid, Electrical)

ELECTRICAL BREAKDOWN IN WATER IN THE MICROSECOND REGIME

D.B. Fenner and R.J. Grishaber
Naval Surface Weapons Center, Dahlgren, VA 22448
2nd IEEE International Pulsed Power Conference Proceedings, pp 122-126
(06/1979).

This paper describes the research on electrical breakdown in water currently being pursued at NSWC/DL. The experimental apparatus is described in some detail. Results of over 500 tests are presented. Breakdown events were observed predominantly in the 2-10 microsecond time domain for applied electrical fields in the range 200-500 kV/cm. The wide scatter of the breakdown time which is intrinsic to the phenomena requires a careful examination of the statistics of the data. 2 Refs.

Primary Keywords: High Fields; Water Conditioning; Wide Statistical Variation

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7180
(PARTICLE BEAMS, ELECTRON)

(Generation)

PUSED ELECTRON FIELD EMISSION FROM PREPARED CONDUCTORS

G.B. Frazier
Physical Dynamics Co., San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 127-132
(06/1979).

The electron emission characteristics of metal cathodes subjected to pulsed electric fields in the absence of insulating magnetic fields has been investigated experimentally. Uniform electric fields in the range of 0.2-0.8 MV/cm were applied to 50 sq.cm. surfaces under vacuum in single pulses of approximately 60 ns duration at a voltage of approximately 0.5 MV. Bare metals and metals coated with dielectric materials were studied. Results show that bare metals with freshly prepared surfaces can withstand fields of ≥ 300 kV/cm for ≥ 40 ns without significant emission. Emission-induced discharges degrade the surfaces such that full space-charge-limited current densities (100-250 A/cm²) can be obtained at a field as low as 700 kV/cm on subsequent pulses. In the case of coated surfaces, it was found that dielectrics could occasionally suppress emission completely up to approximately 300-400 kV/cm, and that kV/cm a metals could partially suppress emission after having passed a significant current at fields up to 2.6 MV/cm. 12 Refs.

Primary Keywords: Metal Cathode; High Fields; No Magnetic Field; Discharge

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7181
(BREAKDOWN STUDIES)

(Lightning)

INVESTIGATION INTO TRIGGERING LIGHTNING WITH A PULSED LASER

C.W. Schubert and J.R. Lippert
USAF Research Dynamics Lab, Atmospheric Electricity Hazards Group
2nd IEEE International Pulsed Power Conference Proceedings, pp 132-135
(06/1979).

Theoretical and experimental considerations for the triggering of lightning with a high-power pulsed laser are discussed. The basic issues of laser-induced clean air breakdown, aerosol breakdown, and channel heating over a long path for the purpose of initiating and possibly guiding lightning are reviewed. It is shown that long path (of the order of one kilometer) ionization through laser-induced clean air breakdown is theoretically possible. Channel heating over long path appears possible, but requires prohibitive energies. Indications are that long path ionization can be enhanced by taking advantage of the significantly reduced power requirements for aerosol breakdown. The Mt. Baldy, New Mexico, experimental test site for 1978-1979 experiments and triggering attempts is briefly described. 4 Refs.

Primary Keywords: Clean Air Breakdown; Aerosol Breakdown; Channel Heating; Long Path; Theory; Experiment

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7182

(SYSTEMS)

ANALYSIS OF A DISTRIBUTED PULSE POWER SYSTEM USING A CIRCUIT ANALYSIS CODE

L.D. Meopt

BDM Corp., Albuquerque, NM 87106

2nd IEEE International Pulsed Power Conference Proceedings, pp 149-152 (06/1979).

A sophisticated computer code (SCPEPTE), used to analyze electronic circuits, was used to evaluate the performance of a large flash X-ray machine. This device was considered to be a transmission line whose impedance varied with position. This distributed system was modeled by lumped parameter sections with time constants of 1 ns. The model was used to interpret voltage, current, and radiation measurements in terms of diode performance. The effects of tube impedance, diode model, switch behavior, and potential geometric modifications were determined. The principal conclusions were that, since transient output depends so strongly on voltage, diode impedance was much more important than the other parameters, and the charge voltage must be accurately known. 3 Refs.

Primary Keywords: Flash X-ray Machine; Numerical Calculation; Modelling; Transmission Line; Gas Insulation; Impedance; Switching

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7183

(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

DETERMINATION OF LINE VOLTAGE IN SELF-MAGNETICALLY INSULATED FLOWS

C.W. Mendel Jr., J.P. Vandeverde and G.W. Kuswa

Sandia Labs., Albuquerque, NM 87115

2nd IEEE International Pulsed Power Conference Proceedings, pp 153-156 (06/1979).

Resistive and capacitive voltage monitors for self-magnetically insulated lines have been found to be unsatisfactory. However, it is known that the boundary current $I_{\text{sub}}V$ and total current $I_{\text{sub}}T$ are related to line voltage and the total anode boundary current can be used to infer the voltage. In this presentation we show relationships between V , $I_{\text{sub}}V$ and $I_{\text{sub}}T$ which are fairly insensitive to the canonical momentum distribution of flowing electrons. Using these relations we conclude that the voltage can be calculated from $I_{\text{sub}}V$ and $I_{\text{sub}}T$ with moderate accuracy with no knowledge about the particular flow involved, and quite accurately if only two experimentally determined parameters are known. The inferred voltage waveforms will be compared to experimental voltage data. 7 Refs.

Primary Keywords: Voltage Measurement; Boundary Current; Total Current; Canonical Momentum

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7184

(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

THE DESIGN OF SOLENOIDS FOR GENERATING HIGH MAGNETIC FIELDS

P. Byczewski

Institute Of Physics, Polish Academy Of Sciences, Warsaw, Poland

2nd IEEE International Pulsed Power Conference Proceedings, pp 148 (06/1979).

Magnetic fields of high intensity are usually generated by the pulsed discharge of capacitor banks through solenoids. In order to generate the highest fields, exploding coils or field compression techniques are used. However, for experiments it is essential that the coil withstand the electrodynamic forces. This is achieved by employing coils in which the stress exerted by the current density and the magnetic field does not exceed the strength of the material used to build the coil. 0 Refs.

Primary Keywords: Field Compression; Mechanical Forces; Current Density

Secondary Keywords: Abstract Only

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7185

(ENERGY STORAGE, CAPACITIVE)

(Systems)

VERSATILE HIGH ENERGY CAPACITOR DISCHARGE SYSTEM

V.H. Martin

GTE Labs Inc., Waltham, MA 02154

2nd IEEE International Pulsed Power Conference Proceedings, pp 149-151 (06/1979).

The requirements for generating high current pulses of current rise amplitudes over a range of 30 kA at rates from 0 to 1.6 nV are being met through the development of a compact, critically damped LCR discharge system containing a 75F capacitance which can store up to 60,000J of energy. The system comprises four series and electrically isolated capacitor banks, each having 1.15F capacitance and charged to a nominal value of 47kV, which is controlled by a multielement SCR switch and can be discharged through inductors and resistors to provide one-half of a 60-cycle sinusoid at peak current values up to 16,000A. Circuit designs are presented for the isolating diodes and status indication of each of the 500 capacitors, for inverse diodes to protect the polarized capacitors from reverse recovery currents, experiments performed after the main capacitor bank discharge, and for protection of the capacitors from overvoltage conditions. 3 Refs.

Primary Keywords: LCR Discharge System; Sinusoidal Output; Low Frequency; Low Voltage

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7186

(PULSE GENERATORS)

(Line Type)

A HIGH CURRENT PULSER FOR EXPERIMENT 225: INFILTRATING ELECTRON ELASTIC SCATTERING

C. Dalton, G. Krauss and J. Serban

Los Alamos National Lab., Los Alamos, NM 87545

2nd IEEE International Pulsed Power Conference Proceedings, pp 232-235 (06/1979).

In the event of low cost homogeneous extractions of polypropylene sheets, flash chambers have been developed for the formation of nuclear particle detector arrays. This has brought about the need for a pulse power system that will provide high peak currents and low levels of spurious radiation. Each module of 10 flash chambers will require a peak current of 20 kA with a rise time t_{rise}/τ of 150 ns, driving a maximum rate of current rise divided by $400 \text{ kA/microsecond}$. The pulser output must develop a 400 ns rise time with a load of 0.36 ohms with a pulse width of 500 ns. The repetition rate will be one per second. This paper describes the development of such a system and the impact of the physical limitations of present components to meeting an offset on a pulse fidelity. 4 Refs.

Primary Keywords: Pulse Generator; Very Fast Pulse; Replicated; High Pulse Fidelity

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7187

(SWITCHES, CLOSING; BREAKDOWN STUDIES)

(Liquid Gaps, Self, Liquid, Electrical)

A STREAMER MODEL FOR HIGH VOLTAGE WATER SWITCHES

F.J. Sazama and V.L. Kenyon III

Naval Surface Weapons Center, Silver Spring, MD 20910

2nd IEEE International Pulsed Power Conference Proceedings, pp 187-190 (06/1979).

An electrical switch model for high voltage water switches has been developed which predicts streamer switching effects that correlate well with water-switch data from recent Aurora/ANL experiments. Preclosure 'rounding' and postclosure resistive damping of pulse-forming line voltage waveforms are explained in terms of spatially-extensive, capacitive coupling of the conducting streamers as they propagate across the gap and in terms of time-dependent streamer resistance and inductance. The arc resistance of the Casino water switch end of a gas switch under test on Casino was determined by computer fit to be 0.50 1 ohms and 0.310 0.06 ohms respectively. During the time of peak current in the power pulse, energy lost in the water switch during the first pulse is 18% of that stored in the pulse-forming line while similar energy lost in the gas switch is 11%. The model is described, computer transient analyses are compared with observed water and gas switch data and the results - switch resistance, inductance and energy loss during the primary power pulse are presented. 3 Refs.

Primary Keywords: Modelling; Preclosure Phenomena; Capacitive Coupling Of Streamers

Secondary Keywords: Aurora; Casino

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7188

(POWER TRANSMISSION)

(Connectors)

CONTACTS FOR PULSED HIGH CURRENT: DESIGN AND TEST

P. Wildi

University of Texas at Austin, Austin, TX 78712

2nd IEEE International Pulsed Power Conference Proceedings, pp 195-197 (06/1979).

The TET Tokamak required the development of a special contact for pulsed high currents for the split coils of the poloidal system at a location which is highly inaccessible. A solution was found in the form of a special plug contact. A prototype was tested to the failure point using the discharge of a homopolar machine. Design, test setup and test results are described and the results are evaluated in view of other uses such as larger contacts and switches. 3 Refs.

Primary Keywords: Plug Contact; Failure Test; High Current; Mechanical Flexibility

Secondary Keywords: TET Tokamak

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7189

(PARTICLE BEAMS, ELECTRON)

(Generation)

DEVELOPMENT OF HIGH CURRENT ELECTRON PULSE ACCELERATORS AT THE INSTITUTE OF HIGH TEMPERATURES

F.A. Abramyan and G.D. Kulashov

Academy of Sciences of the USSR, Moscow, USSR

2nd IEEE International Pulsed Power Conference Proceedings, pp 202-204 (06/1979).

A short analysis of the problems encountered in the acceleration of long (10E-9 sec and longer) pulsed, relativistic electron beams (PEB) is given. A description of the parameters of the experimental facility developed to study these long-pulsed beams is presented, as well. One of the main sections of research of the PEB conducted at our institute is related to finding ways to create long-pulsed electron beams with currents of the order of 1 kA at an energy of 1 MeV. The program is aimed at studying new energy transfer techniques. 4 Refs.

Primary Keywords: Long Pulse; Relativistic E-beam; Breakdown Time; Collective Ion Acceleration

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7190

(FUSES, FUSING)

FACTORS OF INFLUENCE ON THE PERFORMANCE OF EXPLODING ALUMINUM FOIL FUSES

J.L. Berger

Naval Surface Weapons Center, Dahlgren, VA 22448

2nd IEEE International Pulsed Power Conference Proceedings, pp 237-241 (06/1979).

Aluminum foil fuses were exploded electrically by discharging a capacitor bank into a series combination inductance (approximately 3.7 mH) and fuse. The 2.54 x 2.54 x 0.0023 cm foils were exploded in a vacuum chamber. The time to burst and fuse voltage characteristics were investigated as a function of the fuse environment. Results are given for foils exploded in air, in vacuum, gases and liquids. 17 Refs.

Primary Keywords: Aluminum Foil; Fuse Voltage Characteristics; Environmental Conditions

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7191

(PARTICLE BEAMS, ELECTRON)

(Generation)

EMITTANCE MEASUREMENTS ON FIELD Emitter DIODES

S. Kulke and P. Kihara

Lawrence Livermore Lab., Livermore, CA 94550

2nd IEEE International Pulsed Power Conference Proceedings, pp 209-213 (06/1979).

On the basis of time-integrated emittance measurements, several different types of field-emitter diodes were investigated at 1-3 kA. The experimental parameters were the cathode type, the anode mesh texture, the diode spacing and voltage, and the level of collimation of the emerging beam. Over a wide range, the emittance was found to be proportional to the level of collimation. With the diode spacing fixed, the emittance was found to be essentially independent of the diode voltage and current. The lowest emittances (10-15 mr cm at 400 A) were obtained with a foil-type cathode in a multi-electrode configuration. 5 Refs.

Primary Keywords: Field Emission Vacuum Diode; Cathode Type; Anode Mesh; Spacing; Diode Voltage; Collimation

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7203
(SWITCHES, CLOSING)
(Miscellaneous)

STABILIZATION OF METAL-OXIDE BULK SWITCHING DEVICES WITH DIFFUSED BI CONTACTS
B. Lelevic (1), M. Shoga (1), M. Givish (1) and S. Levy (2)
(1) Rutgers University, Piscataway, NJ 08854
(2) EG&G, Fort Monmouth, NJ 07703
2nd IEEE International Pulsed Power Conference Proceedings, pp 376-380
(06/1979)

Threshold switching from the high to low resistance state has been investigated in the polycrystalline and single crystal Nb_xsub Bi_{2-x} (where x approximately equal 2) metal-oxide devices. Stable and reproducible switching performance is observed in a configuration Bi-Nb_xsub 2-x-Bi where Bi electrodes were covered with Au films. Improvement in the device performance is attributed to the Bi diffusion into Nb_xsub Bi_{2-x} which has been confirmed by the Auger electron spectroscopy. Typical off state resistance of these devices is approximately 100 K ohm and threshold switching voltage in the range from 100 to 2500 V. The delay time t_dsub off is exponentially dependent on the applied voltage V_dsub off/ and at larger V_dsub off as the delay time is less than a nanosecond. Recovery time of a device is approximately 0.5 microsecond as determined by the method of decreasing time interval between two successive pulses. Holding voltage is approximately 40 V. The pulsed switched devices can withstand pulse durations between 0.1-3 microsecond, repetition rate of 100 Hz and current intensities of 10-15 A, or 25 A peak with the applied pulse duration of 20 microsecond, single shot. 6 Refs.

Primary Keywords: Threshold Switching; High Off State Resistance; Low Voltage, Low Current

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7204
(SWITCHES, CLOSING)
(Gas Gaps, Self)

TESTING OF A 100 KV, 100 HZ REP-RATE GAS SWITCH
A. Ramrus and J. Shannon
Maxwell Labs Inc, San Diego, CA 92123
2nd IEEE International Pulsed Power Conference Proceedings, pp 320-324
(06/1979)

A two-electrode gas switch with a self-breakdown voltage of 100 KV was operated at a pulse repetition rate of 100 Hz with bursts up to 10 seconds in duration. The output of a pulse transformer provided the (1-cos omega x t) waveform which charged the switch in about one-half millisecond. The switch discharged with a peak current of about 10 kA and a total charge transfer of about 10 nC into a damped LC circuit. A continuous purge of air through the interelectrode spacing enabled the switch to recover its breakdown voltage between discharges. Flow rates up to 35 SCFM were employed. This paper discusses the dependence of switch jitter and waveform reproducibility on air-flow rate. 3 Refs.

Primary Keywords: Self-breakdown Switch; Rep-rated; Life Test; Performance Test

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7206
(DIAGNOSTICS AND INSTRUMENTATION)
(Systems)

A COMPUTERIZED MEASURING SYSTEM FOR NANOSECOND RISETIME PULSED ACCELERATORS
D. Pelliott, S. Ashby, P. Gillis, K. Nipison and P. Spence
Physical International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 410-413
(06/1979)

We have developed a new computerized diagnostic system for high voltage, high current pulsed. This diagnostic system uses electronic circuits connected to nanosecond response transistors to measure machine performance at critical points. The digitized outputs of these circuits are converted to digital form and directly read into a computer. The major advantages of this system are cost effectiveness and greater accuracy than commonly used oscilloscope or transient analyzer systems in applications where it is not necessary to record full analog diagnostic waveforms. Operation is fully computerized and requires a minimum number of personnel; the system is scalable to very large multi-module generators. 4 Refs.

Primary Keywords: Current Diagnostic; Voltage Diagnostic; High Accuracy; Low Cost

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7207
(INSULATION, MATERIAL; POWER TRANSMISSION)
(Solid, Transmission Lines)

A LOW-INDUCTANCE 2-MW TUBE
Y.C. Chen, K. Mashima and J. Banford
Physical International Co, San Leandro, CA 94577
2nd IEEE International Pulsed Power Conference Proceedings, pp 487-490
(06/1979)

A new multi-stage low-inductance tube for the coaxial Water Generator (Part II) has been designed. Low inductance is achieved by means of a dielectric lens in the center, which produces a field distribution with an inverse λ^{-2} profile. 2 Refs.

Primary Keywords: Vacuum Interface; Electric Field Grading; Low Inductance

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7208
(CIRCUITS, OPERATING DIAGNOSTICS AND INSTRUMENTATION)
(Mechanical Systems)

A 100-Ampere INTERRUPTER TEST FACILITY
W.T. Pausch, W.H. Johnson and A.J. Rees
Los Alamos National Laboratory, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 414-418
(06/1979)

The design of interrupter test facility for 100 ampere power pulse currents is presented. The facility is evaluated to determine the τ_{10} limited current. Two interrupter facilities have been constructed and used for this purpose at Los Alamos, the last several years. In response to the increased demands on interrupting technology, a 100-Ampere facility has been constructed. New features incorporated into this facility include: 1) interrupter rated five times higher than energy storage systems; 2) repetitive ratings; and optical fiber coupled data links; and 3) automated data acquisition systems. Facility details and planned tests on an external 1000-ampere vacuum interrupter are presented. 4 Refs.

Primary Keywords: Interrupter; Breaker; Test Facility; Medium Power; Inductive Source

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7209
(POWER CONDITIONING)
(Systems)

ANALYSIS OF THE MULTIPHASE INDUCTOR-CONVERTER BRIDGE
M. Ensono, R.L. Kustom and R.E. Fuja
Argonne National Lab, Argonne, IL
2nd IEEE International Pulsed Power Conference Proceedings, pp 419-424
(06/1979)

Analytical derivations are presented for inductor-converter bridge (ICB) circuits in which energy is transferred from a storage inductor to a load inductor with solid state bridges. These derivations provide complete analytical circuit solution in contrast to previously available numerical (non-analytical) procedures. The analysis is based on two parallel methods: (1) Fourier expansion of the inverter waveforms and (2) a novel method based on the inherent waveforms of the ICB, labeled square functions. Our analytical values with the results of a three-phase ICB experiment at Argonne National Laboratory. 5 Refs.

Primary Keywords: Inverter; Analytical Analysis; Solid State Bridge

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7210
(POWER CONDITIONING)
(Systems)

APPLICATION OF SUBSYSTEM SUMMARY ALGORITHMS FOR HIGH POWER SYSTEM STUDIES
F.C. Brockhurst
Air Force Aero Propulsion Lab, Wright-Patterson Air Force Base, OH 45433
2nd IEEE International Pulsed Power Conference Proceedings, pp 406-409
(06/1979)

This paper describes the application of subsystem summary algorithms for self-contained power system configuration trade-off studies, and presents the results of a recently completed study. The development of summary weight algorithms for rocket turbines and rotating electric generators is described. These new algorithms are combined with previously developed power conditioning subsystem algorithms in a computer program to automatically study various system configurations. A flow chart of the computer program is included in the paper. The computer program was used to find a minimum weight self-contained power system. Results of the study are presented in this paper. 6 Refs.

Primary Keywords: Computer Aided Design; Continuous Duty

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7211
(PULSE GENERATORS)
(Applications)

APPLYING A COMPENSATED PULSED ALTERNATOR TO A FLASHLAMP LOAD FOR NOVA
B.M. Carter and B.T. Merritt
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 439-462
(06/1979)

The Compensated Pulsed Alternator (CPA) is a large rotating machine that will convert mechanical, rotationally stored energy into a single electrical impulse of very high power. It is being optimized for driving flashlamps in the very large Nova Nd-glass laser system. The machine is a rotary flux compression device, and for maximum performance, it requires start-up current. We report upon a circuit that will provide this current and that will also assist in triggering the flashlamps. This circuit has been tested with a 200 kJ capacitor bank and it is now being tested with a small 200 kJ CPA. Large Novasize machines will require output energies in excess of 5 MJ. We also present empirically tested formulae that will assist in matching the Nova Flashlamp load to any given size CPA machine. 4 Refs.

Primary Keywords: Compulsator; Start-up Current; Flashlamps; Triggering; Impedance Matching

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7213
(POWER CONDITIONING)
(Systems)

BALANCED PARALLEL OPERATION OF FLASHLAMPS

B.M. Carter and B.T. Merritt
Lawrence Livermore Lab, Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 454-458
(06/1979)

A new energy store, the Compensated Pulsed Alternator (CPA), promises to be a cost effective substitute for capacitors to drive flashlamps that pump large ND glass lasers. Because the CPA is large and discrete, it will be necessary that it drive many parallel flashlamp circuits, presenting a problem in equal current distribution. Current division to +/-20% between parallel flashlamps has been achieved, but this is marginal for laser pumping. A method is presented here that provides equal current sharing to about +/-1% and it includes fused protection against short circuit faults. The method was tested with eight parallel circuits, including both open-circuit and short-circuit fault tests. 1 Refs.

Primary Keywords: Parallel Current Sharing; Mutual Inductance; Conductivity

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7214
(POWER TRANSMISSION, INSULATION, MAGNETIC)
(Superconducting Lines)

COMPTON SCATTERING OF PHOTONS FROM ELECTRONS IN MAGNETICALLY INSULATED TRANSMISSION LINES
K.D. Brown and J.P. Vandender
Sandia Labs, Albuquerque, NM 87185
2nd IEEE International Pulsed Power Conference Proceedings, pp 429-432
(06/1979)

Magnetically insulated transmission lines are used for power transport between the injector and the diode during current pulse acceleration. Since the efficiency of the power transport depends on the details of the initial line geometry, i.e., the injector, the dependence of the electron canonical momentum distribution on the injector geometry should reveal the loss mechanism. We propose to study that dependence experimentally through a Compton scattering diagnostic. The spectrum of scattered light reveals the electron velocity distribution perpendicular to the direction of flow. The design of the diagnostic is in progress. Our preliminary analysis is based on the conservation of energy and canonical momentum for single electron in the E and S fields determined from 2-D calculations. For the Mite accelerator with power flow along Z, the normalized canonical momentum, k_{\parallel}/k_0 , is in the range -0.7 < k_{\parallel} < 0.7. For $k_{\parallel} \approx 0$ parallel to and $k_{\parallel} \approx 0$ parallel to our analysis indicates that the scattered photons have 1.1 eV \times k_{\parallel}^2 \times b^2 / 4 π eV for ruby laser scattering and can be detected with PM tubes. 8 Refs.

Primary Keywords: Energy Loss; Canonical Momentum; Compton Scattering; Electron Velocity Distribution

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7215
(PULSE GENERATORS; ENERGY STORAGE; MECHANICAL)
(Rotating Machines; Rotating Machines)

DESIGN OF THE ARMATURE WINDINGS OF A COMPENSATED PULSED ALTERNATOR
ENGINEERING PROTOTYPE
J.H. Gully, W.L. Bird, T.M. Bullion, H.G. Rylander, W.F. Woodson and
H.H. Weldon
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 385-391
(06/1979).

The design of the armature windings of a 6 kV, 70 kA compensated pulsed alternator engineering prototype now under construction at The University of Texas at Austin is presented. Electromagnetic forces acting on the windings and the resulting mechanical and electrical stresses placed on the armature insulation are given. Test results of a program to select the ground plane insulation system are described. Finally, fabrication methods, tooling, and problems encountered during construction are discussed. 7 Refs.

Primary Keywords: Compensators; Analysis; Insulation System
COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7216
(BREAKDOWN STUDIES)
(Electrodes)

FAST RISING TRANSIENT HEAVY CURRENT LARK DAMAGE TO ELECTRODES
A. Watson
Texas Tech University, Lubbock, TX 79409
2nd IEEE International Pulsed Power Conference Proceedings, pp 471-474
(06/1979).

Crests of displaced metal have been observed in rings beyond the crests produced by electrodes by short duration (10-100 ns) heavy current pulses in a variety of dielectric media. Metal is presumed to have melted and flowed radially. The hydrodynamic forces supporting a standing canal wave which is coextensive with the crest. Analysis shows this situation to be invariant under steady melting and the ring diameter is proportional to the square root of spark current as measurement verifies. Erosion is proposed to occur by the breaking of this crest or by its removal under the action of electrostatic forces, in accord with reported experimental data. 2 Refs.

Primary Keywords: Electrode Erosion; Displaced Metal; Crests
COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7217
(PULSE GENERATORS; ELECTROMAGNETIC FIELD GENERATION)

FLUX COMPRESSION: SHEF OPTIMIZATION FOR PULSED ENERGY CONVERSION
W.K. Tuck (1), E.C. Chare (1), W.P. Brooks (1), R.E. Wilcox (2) and
W.D. Markle (2) (3)
(1) Sandia Lab., Albuquerque, NM 87115
(2) Intermec General, Windber, NY
2nd IEEE International Pulsed Power Conference Proceedings, pp 381-384
(06/1979).

A flux compression generator called PULSAR is being developed to meet power requirements for future fusion reactors. Key components of the generator are superconducting magnet, generator coil of normal conductor, and an armature, either a metallic conductor or plasma. Chemical energy is used to increase the mutual inductance between the armature and nested generator coil and superconducting magnet. Flux compression occurs and electrical energy is transferred to a load inductance. This paper will present the results of a study that was conducted to design a suitable superconducting magnet for the PULSAR device. 8 Refs.

Primary Keywords: PULSAR; Flux Compression; Generator; Initial Flux
Generator; Superconducting Magnet Coil; Direct Load
Connection

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7218
(PULSE GENERATORS)
(Rotating Machines)

THE DESIGN, ASSEMBLY, AND TESTING OF A DESK MODEL COMPENSATED PULSED
ALTERNATOR
M.A. Pichot, W.L. Bird, M. Brennan, M.D. Driga, J.H. Gully, H.G.
Rylander, K.M. Tolik, W.F. Weldon and H.H. Weldon
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 398-401
(06/1979).

The Center for Electromechanics (CEM) at The University of Texas is currently involved in the design, fabrication, and testing of a prototype compensated pulsed alternator (compulsator). This machine, a novel concept in pulsed power technology, utilizes the principles of magnetic induction and flux compression to convert rotational energy directly into electrical energy. The subject of this paper is a one-fifth scale version of the CEM prototype. This desk model compulsator is a portable demonstration machine designed to operate in the same fashion as the full scale model. 5 Refs.

Primary Keywords: Compulsator; Prototype; Design Considerations

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7219
(PULSE GENERATORS; ENERGY STORAGE; MECHANICAL)
(Rotating Machines; Rotating Machines)

MECHANICAL DESIGN OF A COMPENSATED PULSED ALTERNATOR PROTOTYPE
M. Brennan, W.L. Bird, M.A. Pichot, M.M. Spenn, K.M. Tolik, W.F. Weldon,
H.G. Rylander, H.W. Woods
2nd IEEE International Pulsed Power Conference Proceedings, pp 392-397
(06/1979).

A prototype of a compensated pulsed alternator (compulsator) is presently under construction at the Center for Electromechanics (CEM) at The University of Texas at Austin. The unique machine configuration and high output current (110 kA) generate large forces not typically seen by conventional rotating machines. The rotor is made of 2311 laminations stacked fitted on a vertical shaft. Since the rotor is 110 kA, it has a maximum torque of 51.6 N-m. The insulated laminations are bonded to the ends with large Belleville washers to increase the effective stiffness. The stator is mounted on a frame which allows it to rotate during discharge to reduce the forces it must withstand. The mechanical considerations and design of this machine are presented. 4 Refs.

Primary Keywords: Compulsator; Mechanical Design; Rotor Design; Stator
Design

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7220
(PULSE GENERATORS)
(Applications)

APPLYING A COMPENSATED PULSED ALTERNATOR TO A FLASHLAMP LOAD FOR
HOVA-PART II
W.L. Bird, D.J.T. Mayhall, W.F. Weldon, H.G. Rylander and H.H. Weldon
University of Texas at Austin, Austin, TX 78712
2nd IEEE International Pulsed Power Conference Proceedings, pp 463-466
(06/1979).

The compensated pulsed alternator (compulsator) has been proposed as a possible alternative to capacitor banks for driving xenon flashlamps for pumping neodymium glass laser amplifiers and HOVA. An algorithm for sizing rotor diameter and angular velocity as a function of flashlamp impedance, peak current, and delivered energy is described. The effect when matching the armature inductance variation is a major consideration when matching the pulsed alternator to the load. Finally, conceptual design parameters of a four pole, laminated rotor compulsator are presented. 5 Refs.

Primary Keywords: Compulsator; Start-up Current; Flashlamp Triggering;
Impedance Matching

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7221
(ELECTROMAGNETIC LAUNCHERS; PULSE GENERATORS)

Railguns; Systems)

A COMPACT 5E12 AMP/SEC RAIL-GUN PULSER FOR A LASER PLASMA SHUTTER

L.P. Bradley, E.L. Orman and L.F. Stover
Lawrence Livermore Lab., Livermore, CA 94550

2nd IEEE International Pulsed Power Conference Proceedings, pp 467-470
(06/1979).

We have developed a rail-gun plasma source to produce a plasma of 1.621 cm^{-3} particle density and project it with a velocity of $3.9 \text{ cm/microsecond}$. This device will be used in an output spatial filter of Nova to project a critical density plasma across an optical beam path and block laser retroreflected light. The object of this paper is to describe the design of a pulser appropriate to the Shiva laser fusion facility, and to describe the preliminary design of a higher current prototype pulser for Nova the laser fusion research facility under construction at Lawrence Livermore Laboratory. 3 Refs.

Primary Keywords: Exploding Wire; Multiple Switches; Low Jitter;

Triggering; Nonlinear Load Effect

Secondary Keywords: Shiva (LLNL); Nova

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7222
(ENERGY STORAGE; CAPACITIVE)

(Marx Generators)

REVIEW AND STATUS OF ANTARES

J. Jensen
Los Alamos National Labs, Los Alamos, NM 87545
2nd IEEE International Pulsed Power Conference Proceedings, pp 31-41
(06/1979).

The Antares laser fusion effort at the Los Alamos Scientific Laboratory (LASL) has evolved from early experiments with an electron-beam-controlled large-aperture CO₂/laser to the massive engineering task of designing and building a 100-kJ laser fusion machine. The design of Antares is based on the design of its predecessors. It builds upon technology which was developed or advanced during the design and construction of earlier machines. On one hand it is dictated by the requirements for the output, i.e., energy on target; on the other hand it is limited by existing technology or reasonable extensions thereof. Reliability and maintainability play important roles in the design considerations. 16 Refs.

Primary Keywords: Gas Laser; Beam Propagation; E-beam Pumping; Marx
Generator

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7223
(REVIEWS AND CONFERENCES)

(Reviews)

THE NEAR AND LONG TERM PULSE POWER REQUIREMENT FOR LASER DRIVEN
INERTIAL CONFINEMENT FUSION

W.L. Gagnon
Lawrence Livermore Lab., Livermore, CA 94550
2nd IEEE International Pulsed Power Conference Proceedings, pp 49-54
(06/1979).

Inertial confinement fusion research is being vigorously pursued at the Lawrence Livermore Laboratory and at other laboratories throughout the world. At the Lawrence Livermore Laboratory, major emphasis has been placed upon the development of large, Nd/glass laser systems in order to address the basic physics issues associated with light driven fusion targets. A parallel program is directed toward the development of lasers which exhibit higher efficiencies and shorter wavelengths and are thus more suitable as drivers for fusion power plants. This paper discusses the pulse power needs of the laser fusion program at Livermore. 14 Refs.

Primary Keywords: Laser Fusion; Optical Shutter

Secondary Keywords: Inertial Confinement

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7224
(POWER TRANSMISSION; INSULATION; MAGNETIC)

(Transmission Lines)

SELF-MAGNETICALLY INSULATED POWER FLOW

J.P. Verduwende
Sandia Lab., Albuquerque, NM 87115
2nd IEEE International Pulsed Power Conference Proceedings, pp 55-60
(06/1979).

Electromagnetic power transport through a magnetically insulated vacuum transmission lines has been developed since 1960. Self-magnetic insulation technology, a power density of 1000 W/cm², and over six MWe² transmission at approximately 100 percent efficiency over six MWe². The theoretical understanding of power flow through lines of different cross sections has progressed through analytical theory and electromagnetic particle simulations. However, work needs to be done in the effects of line transitions in which the cross section changes in the direction of power flow. The major features of the present understanding will be reviewed and some promising hypotheses now under investigation will be presented. 34 Refs.

Primary Keywords: High Power Density; Configuration Transition;
Convergent-Divergent Cross Section; Load Impedance

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7225
(PARTICLE BEAMS, ELECTRON)
(Generation)

VOLTAGE DISTRIBUTION AND CURRENT IN A CYLINDRICAL RELATIVISTIC DIODE
N.W. Harris
Ion Physics Corp., Burlington, MA 01803
2nd IEEE International Pulsed Power Conference Proceedings, pp 65-67
(04/1979).

The voltage distribution and current in a space charge limited cylindrical diode are calculated by means of a simple computer program. Relativistic formulation is used, and the results are applicable up to the limit of significant beam pinch. The accuracy is $\pm 1\%$. 3 Refs.

Primary Keywords: Voltage Distribution; Current; Space Charge Limited.
Numerical Calculation; High Accuracy

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7226
(SWITCHES, OPENING)

DEVELOPMENT OF A HIGH-POWER VACUUM INTERRUPTER
J.A. Rich, G.A. Farrell, I. Imam and J.C. Sofianek
General Electric Co., Schenectady, NY 12301
EPRI Report No. EPRI EL-1695 (06/1981).

Availability: EPRI EL-1815
EPRI

Despite their many advantages and their wide use in distribution systems, vacuum interrupters have been too limited in current and voltage for application in today's transmission systems. The goal of this investigation is to assess the feasibility of designing and developing a vacuum interrupter for such applications, to specifically develop a vacuum interrupter with a voltage capability in the 2-80 kV range and a current capability in the 63-80 A range with a continuous current rating of 3000 A. To implement this undertaking, analytical and experimental work was carried out in four major problem areas: arc physics; vacuum breakdown; mechanical problems; interrupter fabrication and test. The leading concern is that of the diffuse vacuum arc, particularly as embodied in electrode structures of rod array type, structures which are capable of carrying very large arcing currents without suffering damage. Corollary to this, a diffuse arc concept is that of arc transfer from the butt contacts to the fixed-gap diffuse arc structure and the separation of functions which this allows. 0 Rats.

Primary Keywords: Vacuum Interrupter; Circuit Breaker; High Voltage;
High Current; Vacuum Arc Physics

COPYRIGHT: 1981 ELECTRIC POWER RESEARCH INSTITUTE, INC., REPRINTED
WITH PERMISSION

7228
(SWITCHES, OPENING; SWITCHES, OPENING)

(Vacuum Gaps, Selfs; Vacuum Gaps; Magnetic Field)
DEVELOPMENT OF A VACUUM ARC FAULT CURRENT LIMITER
R. Dollinger and A.S. Gimbel Jr.
State University of New York at Buffalo, Buffalo, NY 14226
EPRI Report No. EPRI EL-1947 (07/1981).

Availability: EPRI EL-1947
EPRI

The primary purpose of this program will be to develop an understanding of the operating principles of the vacuum arc devices under development at the State University of New York at Buffalo for fault current limiting applications. The general operating characteristics are given for two basic vacuum arc devices. One is the Vacuum Arc Fault Current Limiter and the other is the Magnetically Controlled Vacuum Arc Switch. The results of detailed studies of the phenomena occurring with the two devices are described. In particular, the repetitive voltage striking phenomenon that occurs in the Vacuum Arc Fault Current Limiter is treated in substantial detail. The mechanics of the voltage striking, the repetitive formation and collapse of anode spots are described along with measurements that were made of parameters associated with repetitive striking. Techniques for enhancing current limiting by enhancing voltage striking development are discussed. Work on the magnetized vacuum arc switch and the comparative efforts with the industrial partner (Gould-Brown Boveri) are described. 57 Rats.

Primary Keywords: Current Limiter; Vacuum Interrupter; Vacuum Switch
Gap; Magnetic Control; Modeling; Characteristics

COPYRIGHT: 1981 EPRI, REPRINTED WITH PERMISSION

7230
(POWER TRANSMISSIONS; DIAGNOSTICS AND INSTRUMENTATION)

(Transmission Lines; Systems)
EXAMINATION OF TRANSMISSION LINE ELECTRIC FIELD AND CORONA EFFECTS
S.A. Sober, R.W. DeVore and D.G. Hartman
Ohio State University, Columbus, OH 43210
EPRI Report No. EPRI EL-1751 (07/1981).
Availability: EPRI EL-1953
EPRI

The report investigates the feasibility of an environmental chamber designed with model-scale and full-scale (with reduced spacing) sections for the examination of transmission line electric field and corona effects. The feasibility of tests in a $6 \times 10 \times 10$ mm ($60 \times 100 \times 100$) environmental chamber related to ground level electric field strength, corona starting voltage, conductor surface conditions, corona mechanisms, corona losses, ozone emission, auditory noise, radio noise, and DC corona phenomena. Changes in energizing voltages, geometry, conductor types and materials, and atmospheric conditions are reviewed. Environmental chamber design considerations and preliminary specifications are also outlined with a review of supply requirements and guidelines for instrumentation. The functioning of the chamber is positive. The use of an environmental chamber combined with model-scale and full-scale (with reduced spacings) conductors for the examination of transmission line electric field and corona effects is feasible and meaningful. Such a specialized laboratory environment chamber is not a replacement of full-scale test lines but it is a new tool that serves development and design. The performance of the chamber is comparable to that of a high-voltage outdoor test site. However, the scope of experiments the chamber is much greater than an outdoor test cage. 25 Refs.

Primary Keywords: Transmission Line; Corona; Atmospheric Pressure;
Test Chamber; Design Considerations

COPYRIGHT: 1981 EPRI, REPRINTED WITH PERMISSION

7231
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid; Electrical; Solid)

INVESTIGATION OF MECHANISM OF BREAKDOWN IN XLPE CABLES
A.L. Mekhora, H.C. Doekken, K. Tsuji, and A. Zidon
Philips Dodge Cable and Wire Co., Yonkers, NY 10702
EPRI Report No. EPRI-ID-138 (07/1976).

Availability: EPRI ID-138

This research program explores the basic hypothesis that microporosity plays a significant role in the mechanism of breakdown of XLPE cable. In Part I, the potential improvement achieved by separating the microporous regions of the cable core with a neutral liquid is evaluated with respect to AC life, impulse life and impulse strength. The effect of high frequency is also demonstrated. In Part II, a similar test program is pursued on rod cables, designed to explore the effects of gas pressure and gas type on breakdown and life. Since it is reasonable to expect that only the microporous regions of the insulation should be sensitive to the gas-pressure environment. 26 Refs.

Primary Keywords: Electric Cable; Crosslinked Polyethylene Insulation;
Dielectric Breakdown; Microporosity; High Frequency;
Impulse Voltage

COPYRIGHT: 1976 EPRI, REPRINTED WITH PERMISSION

7234
(SWITCHES, OPENING; BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Mechanical; Fast; Electrical; Vacuum; Electric)

MONITORING OF 1000 DISCHARGES IN POWER CIRCUIT BREAKERS
J.K. Cohen and A.M. Whitham
University of Pennsylvania, Philadelphia, PA 19104
EPRI Report No. EPRI EL-1457 (11/1977).

Availability: EPRI EL-1457

The question that this model attempts to answer is: 'What effect does electrode geometry have on an electric arc? This problem is attacked in a quantitative way in terms of the curvature of the electrodes. The next question is whether after a given interruption attempt, the fault will be cleared. A few types of mathematical attack on this problem was initiated with the model, and it shows that an interruption criterion can be obtained in a rigorous and physically meaningful manner. The results are based on the stability of the mathematical model. The results show how much any interruption depends on arc characteristics and circuit parameters. Real power circuit breakers are influenced by convection and radiation, which are mechanisms for energy dissipation. In order to make the model more realistic, it has been extended to incorporate these effects. Previous experience with the simpler models has given an insight as to how to deal with these complications. 262 Refs.

Primary Keywords: Circuit Breaker; Arc Modeling; Electrode Geometry
Effects; Radiation

COPYRIGHT: 1977 EPRI, REPRINTED WITH PERMISSION

7237
(INSULATION, MATERIAL)

(Composite)

SF/SUB 6/ FOAMED INSULATION

J.G. Cassan
Gulf+Gordon, Chelmsford, MA 18915
EPRI Report No. EPRI EL-520 (08/1977).

Availability: EPRI EL-520

This study describes sulfur hexafluoride (SF₆/sub 6/) epoxy foam, a novel material which consists of a highly electroinsulating SF₆/sub 6/ confined in a network of closed epoxy cells. SF₆/sub 6/ epoxy foam can be prepared by mixing liquid epoxy and molecular sieves that have been presoaked with SF₆/sub 6/. When the mix is heated, the molecular sieves release their adsorbed SF₆/sub 6/, thus foaming the epoxy matrix and creating the SF₆/sub 6/ in small, evenly sized, closed cells. Some of the measured properties of SF₆/sub 6/ epoxy foam indicate this unique material is suitable for high voltage electrical insulation. These properties include a low dielectric constant, a high dielectric strength, the ability to withstand electric strength when punctured by a low power source, insensitivity to heat due to no require vacuum casting, 6 Rats. Electrical insulation, SF₆/sub 6/ epoxy foam; Low Dielectric Constant; Electrical Strength; Puncture Strength; Puncturing Voltage

COPYRIGHT: 1977 EPRI, REPRINTED WITH PERMISSION

7238
(ELECTRODIES)

60 Hz ELECTRODES

SUPERPOSITION GAS BREAKDOWN

G.J. Dale
Westinghouse Research and Development Center, Pittsburgh PA

EPRI Report No. EPRI EL-1484 (08/1980).

Availability: EPRI EL-1484

Results are described of a research program investigating breakdown in a 76/250 mm capacitor system in compressed SF₆/sub 6/ as a result of superposition of impulse voltages on the 60 Hz power frequency voltage. The object of this program is to experimentally determine if impulse superposition is a more severe condition for particle initiated breakdown than the 60 Hz voltage alone, which can result in breakdown voltages as only ten percent of the dielectric strength of SF₆/sub 6/. Breakdown voltages were measured for particles both isolated and in contact with the center conductor and also for multiple free conducting particles in the system for impulse voltages, 60 Hz voltage and with impulses superposed on the 60 Hz voltage. The results showed that the lowest values obtained with the superposition of impulse voltages on 1 or 60 Hz voltage were equal to the lowest values of the 60 Hz or impulse voltages alone. The probability for particle initiated breakdown is a result of superposed impulse voltage with realistic magnitudes of the 60 Hz voltage was found to be negligible and was entirely dominated by the 60 Hz breakdown probability. 17 Refs.

Primary Keywords: SF₆/sub 6/ Gas; Coaxial Electrodes; Power Line
Frequency Voltage; Impulse Voltage; Superposition;

Particulate Suspension; Transmission Line

COPYRIGHT: 1980 EPRI, REPRINTED WITH PERMISSION

**7240
(PULSE GENERATORS)
(Hard-tube)**

A MODULATOR FOR THE SEASAT-A RADAR ALTIMETER
K.Y. Ishikawa, C.T. McCown and G.E. Stronks
Hughes Aircraft Co., Torrance, CA 90509

1978 IEEE Thirteenth Modulator Symposium, pp 235-241 (06/1978).
This paper describes the modulator for the Seasat-A Radar Altimeter. The unit, which consists of a grid modulator, power supply and traveling wave tube (TWT), has been delivered to the Applied Physics Laboratory for their altimeter system in the Seasat-A Global Weather and Ocean Survey satellite. The TWT power supply develops 12 kilowatts at an average power of 70 watts and peak power of 18 kilowatts during normal operation. The grid modulator which operates at the TWT cathode potential switches the grid voltage over a 350 volt range with rise and fall times of less than 50 nanoseconds to gate the TWT RF signal on and off. Transition times of approximately 3 nanoseconds are realized for the RF output pulse. During the pulse operation the cathode voltage is held to within 2 volts by the wide bandwidth cathode voltage regulator. 1 Refs.
Primary Keywords: Grid Modulator; Fast Rise; Fast Fall; Low Voltage; Transistor Switch

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7241
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)**

A STABLE LOAD-INVARIANT HIGH-FREQUENCY SCR SERIES RESONANT INVERTER FOR RADAR TRANSMITTER APPLICATIONS

R.C. Cole
ITT, Nutley, NJ
1978 IEEE Thirteenth Modulator Symposium, pp 14 (06/1978).
A high-frequency series resonant SCR inverter has been developed for radar transmitter power conversion and regulation applications that overcomes most of the limitations of present-day high-frequency SCR inverters. Significant characteristics of the inverter circuit include stable load-invariant regulated capacitor voltages over a wide range of input line voltages and load resistances (including short-circuit loads), fast response, and high efficiency. Low internal stored energy permits automatic reset of faults without destructive failure or reliance on fusing. The inverter is ideally suited for charging of capacitor loads typical of radar transmitter and other pulse-discharge applications. An experimental inverter, operating from 208-V 3-phase ac, provides 30-kW output into a load resistor connected to the inverter through a bridge rectifier and energy storage capacitor. The inverter switching frequency is 10 kHz. Reliable operation with complete freedom from commutation failures has been demonstrated using non-presetted SCRs. Predicted control of inverted resonant capacitor voltages has been shown for all loads, including a short circuit. Two such units can be paralleled to develop a 40-kV 60-kW regulated high-voltage power supply for a radar transmitter. 0 Refs.

Primary Keywords: Stable Operation; Short Circuit Load; Small Internally Stored Energy

Secondary Keywords: Abstract Only

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7242
(SWITCHES; CLOSING; SWITCHES, OPENING)
(Vacuum Tubes; Vacuum Tubes)**

100 KV, 80 AMP. LONG PULSE SWITCH TUBE

S.G. McNeese
Varian EIMAC Div., San Carlos, CA 94070
1978 IEEE Thirteenth Modulator Symposium, pp 180-182 (06/1978).
A high power vacuum grid tube has several characteristics which make it ideally suited for repeated DC high voltage, high current, interrupt applications. It has no moving parts, no arc quenching problems, adjustable current limiting in the case of a shorted lead, and the ability to dissipate power. This latter feature can be used to advantage to pre-program any desired dI/dt during the turn 'on' or 'turn-off' interval. The ability to handle large amounts of dissipation during the 'on' cycle permits the high vacuum power grid device to be used as a voltage regulator; a very attractive feature. A constant voltage over the load is required as in neutral beam sources. The power grid tubes described here have 100 KV, 80 Amps. DC ratings and typically operate at 97 to 95 percent efficiency. They require approximately 25 KW of auxiliary power for filament and driver circuits. 0 Refs.

Primary Keywords: Vacuum Grid Tube; DC Current Interruption; Adjustable Current Limiting; High Efficiency

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7243
(PULSE GENERATORS)
(Pulse Forming Lines)**

DRIVING ROCKEWS CELLS IN MULTI-ARM LASERS

B.M. Carter
Lawrence Livermore Lab., Livermore, CA 94550
1978 IEEE Thirteenth Modulator Symposium, pp 5-8 (06/1978).
This paper describes the method used to drive Rockewell cells on the Lawrence Livermore laboratory Shiva laser (operational since fall), and how this completed a series of 20 target shots. It uses two Rockwell cells gates in each laser arm for suppression of amplified spontaneous emission (ASE) that can damage or destroy the target before the main pulse arrives. Two additional Rockwell cells are used in the preamplification stages, so that a total of 92 cells must be driven by the pulser system. 1 Refs.

Primary Keywords: Transmission Line Pulser; Spark Gap Switch; Variable Load

Secondary Keywords: Rockwell Cell Driver

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7244
(DIAGNOSTICS AND INSTRUMENTATION)
(Data Transmission)**

ELECTRO-OPTIC TRANSDUCERS AND OPTICAL FIBERS IN HIGH VOLTAGE MICROWAVE MODULATORS

P. Cervone and G. Scarch
Selenia SPA, Rome, Italy
1978 IEEE Thirteenth Modulator Symposium, pp 75-78 (06/1978).
This paper describes a new solution for the transfer of information through different voltage levels in a high voltage modulator for gridded microwave tubes. The new solution is realized with the use of electro-optic cell transducers coupled by optic fibers. A description of the transmission channel, the control unit and the failure protection is presented. 2 Refs.

Primary Keywords: Data Transmission; Fiber Optic Link; Remote Control; Processing; Fast Response

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7245
(POWER CONDITIONING)
(Current Limiters)**

ENERGY CONSIDERATIONS IN THE PULSED OPERATION OF A VACUUM ARC CURRENT LIMITER

C.D. Pownall, A.S. Gilmour Jr., R. Dollinger and D.P. Malone
State University of New York at Buffalo, Buffalo, NY 14226
1978 IEEE Thirteenth Modulator Symposium, pp 213-216 (06/1978).
It has been demonstrated at SUNY-Buffalo that a current as high as approximately 120 kA can be limited to approximately 1 kA using a vacuum arc current limiter (VACL). During current limiting a large voltage is developed across the VACL and so a very large impulse of energy is applied to the anode. This paper describes the results of a study that has calculated the current amplitudes with and without the VACL in the system. The resulting energy impulses applied to the device were determined and a transient analysis of the temperature distribution within the anode was made. 4 Refs.

Primary Keywords: Current Limiter; Magnetic Field; High Limiter

Voltage; Anode Temperature Distribution

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7246
(PULSE GENERATORS)
(Line Type)**

HAYSTACK HILL LONG-RANGE IMAGING RADAR TRANSMITTER

W. North
GTE Sylvania, Inc., Needham Heights, MA 02194
1978 IEEE Thirteenth Modulator Symposium, pp 247-253 (06/1978).
The Long-Range Imaging Radar (LRIR), developed by MIT Lincoln Laboratory for the USAF, is presently installed at the Haystack Hill MEPO radarscope facility, in Westford Mass., and uses its 123-foot diameter parabolic reflector antenna. Its transmitter is designed around the Varian VIX-5681 TWT, which was developed specifically for this application under the sponsorship of MIT Lincoln Laboratory. The line voltage is 62 kVdc at 10 amperes, which is gated by means of the output of a direct-coupled flip-flop deck modulator connected to the unity-gain modulating anode of each parallel-connected TWT. The modulators, which use Elmac 8960 switch tubes, is capable of pulse durations of from less than 10 microseconds to CW, and PRFs up to 2000/second. Output amplitude control is accomplished by a direct-coupled grid-cathode circuit applied to the upper switch tube grid. Low-level signal coupling is by means of a balanced, capacitive-coupled 10 MHz links, using microcircuit components. Maximum use was made of the existing 58 kWdc 21 ohm TWTs and the 80 kW, 156 ohm capacitor bank and combination of resistive power source, to augment them with a 20-ampere electron ic current regulator between the TWT and capacitor bank, and a 20-ampere electronic voltage regulator, between capacitor bank and TWT drain input, and an output buffer capacitor bank and separate circulator. Both regulators use Elmac 4CW250,030 tetrodops. 0 Refs.

Primary Keywords: Flying-deck Modulator; High Average Power;

Component Descriptions

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7247
(ENERGY CONVERSION, ELECTRICAL)
(Power Supplies)**

HIGH VOLTAGE DC POWER CONDITIONER

D.L. Pruitt
RCA Corp., Moorestown, NJ 08057
1978 IEEE Thirteenth Modulator Symposium, pp 15-21 (06/1978).
Modern radar systems, particularly mobile systems, require high quantity, compact, lightweight DC power sources. High frequency (e.g., 10 kHz) power conditioning devices have been used to obtain the desired qualities. By adapting a variation of the series inverter circuit, liberally infused with art, facsimile line type pulse modulator technology, an effective, simple, and high performance technique has been developed. Low frequency (50 to 400 Hz) transformers are eliminated by direct full wave rectification of the AC power source. With appropriate input filter design, power source frequencies from 50 to 60 Hz can be accommodated in one case. A pair of suitable high frequency thyristors alternately charge and discharge a pair of capacitors through the primary of a pulse power transformer. Since the switching frequency is high (thousand's of hertz), the transformer and load filter capacitor are small compared to the case of a standard power source. Operation is low (approximately 1.5% of the peak power). Regulation of the output voltage is achieved by varying the pulse occurrence frequency from 1000 to 10000 Hz. The maximum (e.g., 20 kHz) DC load to 100 load regulation 1:100 has been demonstrated. The circuit is not thermally by overheat, and has a current fold-back feature. Normal operation goes on automatically when an overload is removed. 1 Refs.

Primary Keywords: Power Supply; Light Weight; High Frequency

Inverter; Good Regulation

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7248
(SWITCHES; CLOSING)**

(Miscellaneous Solid State)

HYBRID SCR SWITCH

D.L. Pruitt
RCA Corp., Moorestown, NJ 08057
1978 IEEE Thirteenth Modulator Symposium, pp 157-162 (06/1978).
Hybrid solid state switches were designed and constructed using SCR (silicon controlled rectifier) chips on a beryllia substrate. Peak pulse currents of up to 6000 A with 2 microsecond rise time, or up to 300 A with 1 microsecond rise time, were achieved. A series stack was constructed to produce a 10 KV air cooled switch. 4 Refs.

Primary Keywords: SCR Network; High Current; Slow Rise

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

**7249
(SWITCHES; CLOSING; SWITCHES, OPENING)**

(Vacuum Tubes; Vacuum Tubes)

LONG PULSE HIGH EFFICIENCY SWITCH TUBE DEVELOPMENT

G.J. Morrison
U.S. Ordnance AFRL, NY 13440
1978 IEEE Thirteenth Modulator Symposium, pp 183-188 (06/1978).
A high power linear beam triode switch tube was tested and evaluated at KACD's High Power Laboratory. Utilizing the device as a series modulator for a klystron amplifier, parameters attained were 120 KV output at 0.05 duty cycle with pulse lengths up to 300 microseconds. Measurements of efficiency, collector depression, percentage control grid interception, anode (screen grid) current and collector dissipation were performed. The ability to control the pulse width and shape was demonstrated at a variety of voltage and current levels. These results indicated that operation at 100 KV, 130 amperes at 0.05 duty could be achieved with an appropriate load. The test switch tube was designed and fabricated by Varian Associates under RADC sponsorship. Details of the advantages of this development of Varian's preliminary testing are covered. In addition to klystron system evaluation, 2 Refs.

Primary Keywords: Linear Beam Triode; Series Modulator; Pulse

Switching; High Efficiency

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7258

(SWITCHES, CLOSING; SWITCHES, OPENING)

(Vacuum Gaps; Electrical; Vacuum Gaps; Magnetic Field)
MAGNETIC FLUX CONCENTRATOR WITH THE ANODE IN A VACUUM ARC SWITCH
Y. Suzuki and A. Lemoine Jr.
State University of New York at Buffalo, Buffalo, NY 142261978 IEEE Thirteenth Modulator Symposium, pp 208-212 (06/1978).
The anode of a vacuum arc switch may be used as a magnetic flux concentrator. This is done to permit the use of a large diameter field coil, perhaps located outside the vacuum envelope, for generating large magnetic flux densities in the anode-cathode interelectrode region. The time required for the magnetic flux to decrease substantially in density because of diffusion through the anode is of interest in switch applications where it is necessary for the arc interruption process to be relatively slow. In this paper measured flux diffusion speeds through a vacuum arc switch anode are compared with those calculated using the diffusion equation subject to boundary conditions in two limiting cases. 2 Refs.

Primary Keywords: Magnetic Flux Concentrator; Field Diffusion; Anode Processes

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7251

(SWITCHES, OPENING; SWITCHES, CLOSING)

(Vacuum Gaps; Magnetic Field; Vacuum Gaps; Electrical)

MAGNETICALLY MODULATED VACUUM ARC FOR DC SWITCHING
R. Dethlefsen and J. Mylne
Gould Inc., Greenbush, Pa. 156011978 IEEE Thirteenth Modulator Symposium, pp 222-226 (06/1978).
Experiments are reported on vacuum arcs in a magnetron-type discharge geometry. Magnetic fields up to 0.6 Tesla are applied. Various de-gassed cathode materials are tested at currents up to 10 kA. Depending upon geometry, the magnetic field can raise the vacuum arc voltage from typically 150 V to several kV. The probable cause is an electron space charge current limitation in front of the ring shaped anode. Dependent upon parallel capacitance, strong oscillations are excited by the magnetic field. Application of the magnetic field can reduce the arc current from several kA to the current chopping level, where circuit interruption is followed by rapid dielectric recovery. High repetition rates in the kHz region appear feasible. 2 Refs.

Primary Keywords: Magnetron-type Discharge; Magnetic Modulator; Low Field; Self-generated Field

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7252 (PULSE GENERATORS)

(Hard-tube)

PEAK SWITCH CURRENT ENHANCEMENT FILTER

J.P. O'Loughlin (1) and W.M. Moeny (2)
(1) AFAL, Kirtland AFB, NM 87117
(2) Tetra Corp., Albuquerque, NM1978 IEEE Thirteenth Modulator Symposium, pp 52-54 (06/1978).
One method of providing ionization in a controlled gaseous discharge is to apply very short over voltage pulses. The voltage is typically several times the breakdown voltage of the gas but the time duration is less than the arc formation time so a complete breakdown does not occur but the gas is ionized. The level of ionization achieved depends on the total charge or equivalently the peak current delivered during the over voltage pulse. Typical parameters used in one experiment were 50 to 100 nanosecond pulses at 35 kV and repetition rates up to 500,000 FPPS. A hard tube modulator was designed and built to deliver up to 200 peak amperes. Later in the experiment higher currents were desired and it was found that by using a peak current enhancement filter it was possible to deliver peak current of 350 amperes to the load while the hard tube modulator was only switching 200 peak amperes. The design and characteristics of such a filter is described in the paper. 3 Refs.

Primary Keywords: Peak Current Enhancement; 50% Peak Current Increase; Hard Tube Pulser; PI Section Filter; Narrow Pulse

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7253

(POWER CONDITIONING)

(Pulse Forming Networks)

PFN LOSS CALCULATIONS

S.I. Rambo and R.A. Gardenghi
Westinghouse Electric Corp., Baltimore, MD 21203

1978 IEEE Thirteenth Modulator Symposium, pp 43-45 (06/1978).

Approximation methods for the calculation of PFN losses have been used for many years. With the availability of computer facilities to most electronic engineers today, more precise calculations can be made. Now PFN's designed for the power conditioning have had a change in emphasis. High voltage, low current could be a larger safety factor. The recent trend to all-solid-state pulsers requiring very low Z and V (less than 1 ohm) and high pulse current capability makes it essential that distribution of losses be determined more accurately. This paper describes a proven useful approach using simple time-shared computer programs. Methods are described for loss calculations by first determining the pulse current shape in each coil and capacitor in the time domain. Then these pulses are transformed into the frequency domain to determine their spectra. By knowing pitch & Q of the coils and the dissipation factor of the capacitors and how they vary with frequency, it is easy to sum the losses for each spectral line for each component. Results agree well with experiments. 0 Refs.

Primary Keywords: Loss Calculations; Numerical Calculation; Solid State Pulse Power Impedance; Comparison With Experiment

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7255

(ENERGY CONVERSION, ELECTRICAL)

(Power Supplies)

PULSED TWT POWER SUPPLY: A TECHNIQUE FOR MINIMIZING R.F. PHASE INSTABILITY AND HIGH VOLTAGE ENERGY

F. Terantino and P. Porcino
Selettra SPA, Roma, Italy1978 IEEE Thirteenth Modulator Symposium, pp 22-26 (06/1978).
The ripple voltages on the electrodes of the power microwave tube limit the performance of M.I.I. radar system. When the radar employs staggered R.F. pulse-to-pulse ripple arises due to load duty changes for IMI power supply. The variation of the electrode body in the pulse shape and amplitude modulation of the transmitted wave form, it is possible to reduce the cathode voltage variation by increasing the value of the H.V. capacitors, but if this solution the stored energy increases too. Series regulator is another alternative but this means more sophisticated circuitry with decreasing of reliability and more design efforts. This paper describes a H.V.F.S. configuration which allows to solve the problem with limited H.V. stored energy. 5 Refs.

Primary Keywords: Detailed Analysis; Voltage Multiplication; Ripple Compensation; Minimum Stored Energy

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7256

(SWITCHES, CLOSING)

(Gas Gaps; Crossed-field)

THE CROSSED-FIELD CLOSING SWITCH-A STATUS REPORT

R.J. Harvey (1), R.W. Holly (1), J. Creedon (2) and H. Gauch (2)
(1) Hughes Research Labs, Malibu, CA 90265
(2) ECM, Fort Monmouth, NJ 07703

1978 IEEE Thirteenth Modulator Symposium, pp 79-82 (06/1978).

The crossed-field closing switch (CFC5) has been evaluated using a modulator consisting of 25 cables each 15.24 m long. A low-inductance 2-ohm copper sulfate load was used to terminate the modulator in its characteristic impedance. Before evaluating the CFC5 in the cable modulator, studies were made of firing characteristics and mode of operation using a conventional pulse forming network of 0.5 ohm impedance matched to a copper sulfate load. The pulse width was a nominal 12 microseconds. Preliminary results were then obtained with this cable modulator at an anode voltage of 23 kV and a peak current of 6 kA and pulse repetition rates of 4-500 Hz. The pulse width, measured at the half power points on the load, was 160 ns. Experimental results are shown for the cable modulator test, and the dependence of operating mode on circuit parameters is discussed. 6 Refs.

Primary Keywords: Performance Test; Rep-rated; Parameter Study

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7257

(SWITCHES, OPENING)

(Mechanical)

THE USE OF VACUUM INTERRUPTERS AND BYPASS SWITCHES TO CARRY CURRENTS FOR LONG TIMES

E.M. Honig and P.H. Warren
Los Alamos National Labo, Los Alamos, NM 87545

1978 IEEE Thirteenth Modulator Symposium, pp 194-199 (06/1978).

Vacuum interrupters are normally designed for use in AC utility circuits where they typically carry a maximum continuous current of 2 kA but must interrupt fault currents well in excess of 25 kA. Vacuum interrupters are also used to carry and interrupt the large DC currents found in fusion devices such as tokamaks. In contrast to AC uses, however, these DC applications usually require that the continuous current limit be the same as the interruptible current limit. In a previous paper we have reported tests performed at the Los Alamos Scientific Laboratory (LASL) which show that the interruption ability of standard vacuum interrupters used with DC currents is satisfactory for currents in excess of 20 kA little, however, doubt about the ability of standard interrupters to carry such large currents for long times. It is the purpose of this paper to describe measurements which determine the period of time conventional interrupters can carry currents as large as 20 kA without compromising their interruption ability; describe special interrupters which should extend this period; describe a bypass switch we have built and two ways of using it to relieve the vacuum interrupter of its heating load; describe the bypass switch experimental setup and test results; and discuss ways to extend the life of the bypass. 8 Refs.

Primary Keywords: DC Current Rating; Bypass Switch

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7258

(SWITCHES, OPENING)

(Mechanical)

THE USE OF VACUUM INTERRUPTERS AT VERY HIGH CURRENTS

R.W. Warren and E.M. Honig
Los Alamos National Labo, Los Alamos, NM 87545

1978 IEEE Thirteenth Modulator Symposium, pp 189-193 (06/1978).

There is a slowly growing, widely based need for switches which can be used to interrupt DC currents. In recent years the demands of fusion devices such as tokamaks have overshadowed all others and have eliminated the need for conventional switches with vastly improved performance or for better, entirely new kinds of switches. Switches presently being developed for tokamaks uses must interrupt 20 kA at 25 kV with a reliability of 99% or so for a total of 100 thousand of cycles. Next generation tokamaks may operate at 100 kA and 100 kV and require switches with a reliability of 99.9% and a much longer life. No standard switch can meet these requirements. A promising approach to these goals is based upon a vacuum interrupter used in conjunction with a commutating counterpulse capacitor bank. This bank is used to create a forced current zero at which interruption can occur. 13 Refs.

Primary Keywords: Vacuum Interrupter; DC Current Interruption; Current Commutation; High Reliability; Magnetic Field

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

7261

(PARTICLE BEAMS, ELECTRON)

(Generation)

AURORA, AN ELECTRON ACCELERATOR

B. Bernstein and I. Smith
Physical International Co., San Leandro, CA 94577

IEEE Transactions On Nuclear Sciences, Vol. NS-20, No. 3, pp 294-300 (04/1973).

Aurora was designed to produce a brief, intense radiation pulse, and the electrical specifications derive from the radiation output required. A "test volume" was defined that was roughly a meter cube. It was desired to irradiate this from one side to an average of 50,000 Roentgens throughout. In the laboratory, such yields can only be obtained by the bremsstrahlung from a high intensity electron beam stopped in a high density "converter". To maximize the efficiency of conversion of electron energy into photon energy, the highest possible kinetic energy was selected, consistent with the desire not to produce an excessive secondary fission-neutrons. The kinetic energy chosen was 15 MeV. Calculations then showed that the dose in the test volume could be achieved with minimum electron energy if the radiation source were a uniformly energized surface about 1.5 m in diameter, placed near one face of the test volume. This source surface is the converter, which must be illuminated by a fairly uniform electron beam. The total charge of 15 MeV electrons needed per pulse was calculated to be about 0.2 C. An electron beam pulse duration of 120 ns was chosen to give the desired radiation pulse duration to allow for the finite rise and fall times of the beam pulse. Thus an electron beam specification of 1.6 MA at 15 MeV was arrived at, giving a peak power of 24 terawatts and a total beam energy of almost 3 MJ per pulse. 2 Refs.

Primary Keywords: AURORA Accelerator; Design Considerations; Field Emission Diode; Blumlein Line; Marx Generator;

COPYRIGHT: 1973 IEEE, REPRINTED WITH PERMISSION

7266
(PULSE GENERATORS; POWER CONDITIONING; PARTICLE BEAMS, ELECTRON)
(Marx; Pulse Transformers; Generation)
COUPLED MARX-TESLA CIRCUIT FOR PRODUCTION OF INTENSE RELATIVISTIC ELECTRON BEAMS

A. Luches and A. Perrone
Universita di Lecce, Lecce, Italy
The Review Of Scientific Instruments, Vol. 49, No. 12, pp 1629-1630 (12/1978).

A two-stage Marx circuit was built and is used to multiply the input energy of our Tesla resonant transformer accelerator without loss of resonance conditions. The present output characteristics of our coupled Marx-Tesla circuit are compared to those of the previous Tesla transformer. With the same input voltage and cathode to anode distance, we succeeded in doubling output voltage and current of the beam. 4 Refs.

Primary Keywords: E-beam Generation; Marx Generator; Tesla Transformer; 1 MV Accelerating Voltage

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7268
DESIGN AND DEVELOPMENT OF A 350 KV, 100 PPS ELECTRON BEAM ACCELERATOR
G.J. Rothstein, M.T. Buttner and K.R. Prestwich
Sandia Labs, Albuquerque, NM 87115
No. CONF-771035-10-C4B (11/1977)
Available: SAND-77-1287C
NTIS

A 350 KV, 300 J/pulse, 100 pulse/sec electron beam accelerator was designed and constructed. A description of the physical features of the machine is included along with performance data from the initial operation of the system. (ERA citation 03-010865)

Primary Keywords: Accelerators; Design; Electron Beams; Key Range 100-1000; Performance; Pulse Circuits; Pulses; Switches; Transformers

Secondary Keywords: ERDA/43010C; ERDA/700208; NTISDE

7275
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

FUSION APPLICATIONS OF FAST DISCHARGING HOMOPOLAR MACHINES

K.I. Thomassen
Los Alamos National Labs, Los Alamos, NM 87545
EPRI Report No. ER-625 (01/1978).

Availability: EPRI ER-625

The use of fast discharging homopolar machines, with 1-5000 ms. delivery times, are described for toroidal and linear theta pinches, toroidal z-pinchers, liners, and tokamaks. Typical circuits and machine designs are described. 10 Refs.

Primary Keywords: Fast Discharge; Modeling

Secondary Keywords: Fusion Driver

COPYRIGHT: 1978 EPRI, REPRINTED WITH PERMISSION

7276
(PARTICLE BEAMS, ELECTRON)
(Generation)

HIGH CURRENT PULSED ELECTRON BEAM GENERATOR

I. Smith, P. Champney, L. Hatch, K. Nielsen and S. Shore
Physic International Co., San Leandro, CA 94577
IEEE Transactions On Nuclear Science, Vol. NS-18, No. 3, pp 491-492 (03/1971)

A review is given of a simple and economical method of generating high-current electron beams in the range of a few hundred kiloamperes to multi-kilogrammes at voltages from 100 KV to 1 MV. Mylar dielectric parallel plate transmission lines, switched with either solid dielectric spark gaps or gas spark gaps constitute the pulse forming network. Several such generators have been built that feed a 50 nsec width pulse through a low inductance insulator/vacuum interface to a field emission diode. The electron beam is generated in the diode region and accelerated through this window into a drift chamber. One such generator is described in detail. 2 Refs

Primary Keywords: Field Emission Diode; Drift Tube; Strip Line; Mylar Insulation; Water Encapsulation; Boundary Considerations; Pulse Forming Network

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

7280
(POWER TRANSMISSION; POWER CONDITIONING)
(Transmission Lines; Pulse Transformers)

IMPEDANCE MATCHING BY TAPERED TRANSMISSION LINES

A.W. Gent and P.J. Wallis
Standard Telecommunications Ltd.
Proceedings Of The IEE, Vol. 51, Part IIIA, No. 3, pp 559-563 (03/1964).

Tapered transmission line sections are analyzed in this paper. The standing wave ratio is measured for a tapered line terminated in a coaxial line. It is found that best performance is obtained when the tapered line is equal in length to one half-wavelength. It is also found that the preferred geometry is to taper the inner and outer conductors together. 7 Refs.

Primary Keywords: Impedance Matching; SWR Measurement; Simultaneous Tapering Of Conductors; Tapered Section Length

COPYRIGHT: 1964 IEE

7284
(DIAGNOSTICS AND INSTRUMENTATION)
(Currents)

NANOSECOND RESPONSE 'GASKET-TYPE' MAGNETIC LOOP CURRENT MONITOR FOR RELATIVISTIC ELECTRON BEAM CURRENT MEASUREMENTS

R.L. Copeland (1), J.L. Adamski (1), W.O. Doggett (2), D.L. Morrow (2) and W.H. Bennett (2)

(1) Boeing Aerospace Co, Seattle, WA 98124

(2) North Carolina State University, Raleigh, NC 27607

The Review Of Scientific Instruments, Vol. 50, No. 2, pp 233-235 (02/1979).

A fast response magnetic loop current monitor has been developed to measure relativistic electron beam return currents. The monitor has a rise time of about a nanosecond and a high degree of symmetry with moderate sensitivity, variable from about 1 to 10 V/KA. This simple monitor, with a thickness of 1.254 mm or less, is thin enough to be placed between segments of return current path in the diode or drift tube regions, is insensitive to flashover, born and plasma bombardment, and radiation effects, and measures net current, thus offering some advantages over conventional magnetic probes, since the main components are outside of the vacuum region. Design criteria, an equivalent circuit analysis, and typical calibration waveforms are presented. Experimental current measurements for a pinched electron beam diode configuration using both conventional magnetic probes and gasket-type current monitors with the FX-75 relativistic electron beam accelerator are presented. 5 Refs.

Primary Keywords: Current Monitor; Electron Return Current; Return Current Path; Fast Response; 1 ns Rise Time; Environmental Insensitivity; Design Considerations

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7285
(BREAKDOWN STUDIES)

(Surface Flashover)

NANOSECOND SURFACE DISCHARGE STUDY BY USING DUST FIGURE TECHNIQUES

Y. Murakami and S. Kiyama
Defense Academy Of Japan, Chiba-ku, Yokosuka, Japan

Journal Of Applied Physics, Vol. 44, No. 4, pp 1516-1520 (04/1973).

The developing mechanisms of the positive and negative corona streamers on the insulation surface have been studied by using the dust figure technique together with a line pulser. The present method has the advantage of measuring the velocity of corona discharge development and the discharge mechanism, because the distributions of the positive and negative streamer tips can be colorfully separated and recorded. By applying short-pulse pulses from 10- to 920-nsec duration to a needle point where a glass plate is sandwiched in between the needle and plate electrodes, the diameter of the recorded discharge and the charge quantities and their distributions against the pulse duration were obtained. The observed average velocities of the developing corona streamers at a voltage of 12.0 KV were 2.05E8 cm/sec in the positive and 0.63E8 cm/sec in the negative, respectively. Moreover, when the negative pulse voltage was applied to the needle point the formation time lag of the cathode fall was about 10 nsec and the resulting high densities of the positive and the negative charges induced a back discharge. 20 Refs.

Primary Keywords: Surface Flashover; Corona; Polarity Effect; Dust Figure; Pulse Technique; Corona Velocity; Point Cathode

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7290
(PARTICLE BEAMS, ELECTRON)

(Generation)

SELF-ACCELERATION EXPERIMENT BY INTERRUPTION OF AN INTENSE ELECTRON BEAM

Z.A. Grishnev, V.V. Zekulin, N.N. Nasonov, A.A. Rakityanski and A.M. Chenderovich

Kharkov Institute, Academy of Sciences of the Ukrainian SSR, Kiev, USSR

Soviet Technical Physics Letters, Vol. 1, No. 7, pp 275-276 (07/1975). Transl. from Pis'ma Zhurn. Tekhn. Fizika 1, 612-615 (July 1975).

One of the most promising methods of accelerating a strong current electron beam is self-acceleration with the aid of an accelerating system excited by the beam. In the published experiments on self-acceleration of kiloampere electron beams it is found that the beam energy is increased by less than two times. The present paper is a brief compilation of the results of experiments on self-acceleration followed by excitation of an accelerating system by the trailing edge of a current pulse of high-intensity electrons in a beam in which a much larger energy increment is obtained. 8 Refs.

Primary Keywords: Beam Generation; Self-acceleration; Short Trailing Edge; Beam Energy Measurement; Gun Voltage; Gun Current; Blank Circuit

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7292
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)

(Generation; Diagnostics)

THE GENERATION AND DIAGNOSIS OF PULSED RELATIVISTIC ELECTRON BEAMS ABOVE 1000 WATTS

S.E. Graybill and S.W. Neblo
Varian Physics Corp, Burlington, MA 01801

IEEE Transactions On Nuclear Sciences, Vol. NS-14, No. 3, pp 782-788 (06/1967).

A review of the several approaches to the generation of intense electron streams in the megavolt energy regime is presented. The techniques used in the diagnosis of the 30,000 amperes, 3 MeV beam from a gas insulated coaxial system with a characteristic pulse length of 25 nanoseconds are discussed. The general features of such a stream drifting under self-focusing conditions are presented and the results compared with other theories such as idealized beam. The results are also conducted with cathode arrays of various geometries are discussed. In particular, the dynamics of 20,000 ampere streams at 2 MeV from arrays with $1 \leq n \leq 4$, are presented. Based on these data, a prognosis is made for the limitations of future high peak power electron accelerators at energies in the 10 MeV range. 8 Refs.

Primary Keywords: E-beam Generation; E-beam Diagnosis; 3 MeV Beam Energy; 30 KA Beam Current; 25 ns Pulse Length; Self-focusing; Cathode Array

COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION

7296
(POWER CONDITIONING)
(Saturable Reactors)

THE USE OF SATURABLE REACTORS AS DISCHARGE DEVICES FOR PULSE GENERATORS
W.S. Melville
British Thomson-Houston Co., Ltd.
Proceedings of the IEEE, Vol. 58, Part III, No. 53, pp 185-208 (05/1951).

The use of saturable reactors as pulse sharpening elements is the subject of this paper. The author begins with a short historical background of saturable reactor uses and proceeds to define the requirements of such a reactor for pulse sharpening techniques. The hysteresis loops of typical magnetic materials are studied with pulse sharpening in mind. A study of several parameters is presented, as well as several possible applications. 8 Refs.

Primary Keywords: Saturable Reactors; Recurrent High-power Pulse Generation; Electronic Discharge Devices; Historical Background; Post-pulse Oscillations; Pulsator Circuits; Long Life; Instantaneous Operability; Added Condenser Built-in

COPYRIGHT: 1951 IEEE, REPRINTED WITH PERMISSION

7298
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

ULTRAFAST HIGH VOLTAGE PROBE
G.E. Leavitt, J.D. Shipman and J.M. Vithovitsky
Naval Research Lab, Washington, DC 20375

The Review Of Scientific Instruments, Vol. 36, No. 9, pp 1371-1372 (09/1965).

We have developed high voltage probes that have operated in a range of 50 to 600 kV. The high frequency response of the probe was determined to be about 500 MHz. These probes have been applied in exploding wire and theta-pinch work. The probes consist of a capacitive voltage division to a level at which single non-inductive film resistors can be used. One such resistor in series with the transmission line is terminated by a matched recording oscilloscope input impedance, serves both as an additional voltage divider and as a part of an RC network with a time constant chosen to be much longer than the pulses to be measured. 5 Refs.

Primary Keywords: Voltage Probe; Capacitive Divider; Resistive Divisor; Terminator; 100 kV Operating Voltage; 18 MHz Bandwidth

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7300
(BREAKDOWN STUDIES)

(Liquid; Electrical)

'DIFFUSION' ELECTRODES FOR INVESTIGATION OF THE BREAKDOWN OF LIQUID DIELECTRICS

D.D. Ryutov

Journal Of Applied Mechanics And Technical Physics, Vol. 13, No. 4, pp 596-597 (08/1972).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 4, 186-187 (July-August 1972)

A method which excludes the effect of electrode microinhomogeneities on the breakdown of a liquid is proposed. The method consists in forming at the surface of each electrode a transitional layer with a conductivity which gradually decreases with increasing depth in the liquid. 1 Ref.

Primary Keywords: Liquid Breakdown; Diffusion Electrodes; Electrode Effects Eliminated; Transitional Layer; Electrical Conductivity; Spatial Resolution

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

7303
(BREAKDOWN STUDIES; INSULATION; MATERIAL)

(Liquid; Electrical; Liquid)

INCREASE OF DIELECTRIC STRENGTH OF WATER IN A SYSTEM WITH 'DIFFUSION' ELECTRODES

V.V. Vorob'ev, V.A. Kapitonov and E.P. Kruglyakov

Nuclear Physics Institute, Academy of Science of the USSR, Novosibirsk, USSR

JETP Letters, Vol. 19, No. 2, pp 58-59 (01/1974).

Trans. From: ZhETF Pis'ma v Redaktsii, v. 19, 95-98 (January 1974).

Results are presented of an investigation of the dielectric strength of pure water when the electrodes are shielded with two conducting layers. It is established that a sliding electron-electrode surfaces greatly increases the electric strength of water. 2 Refs.

Primary Keywords: Dielectric Strength; Diffusion Electrodes; Electrode Surface Shielding; Surface Breakdown; Field Intensity Collocation; Diffusion Layer

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7315
(BREAKDOWN STUDIES)

(Gas; Electr.)

DEVELOPMENT OF SPARK IN AIR FROM A NEGATIVE POINT

E. Neher

Johns Hopkins University, JHU, IA 30010

The effect of an anode used as a new detecting and diagnostic technique has been applied to the study of the voltage breakdown of air between a point cathode and a positive plane. 'Feathers' were found to propagate at velocities almost 5% of the velocity of light. When they approach the positive plane, they produce 'retrograde streamers' that turn back, the gap and eventually lead to the completion of a plasma channel of high conductivity. 12 Refs.

Primary Keywords: Point-plane Gap; Air Gap; Streamer; Velocity High Propagation Velocity; Retrograde Streamer

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7385
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Vacuum; Electrical; Electrode)

EFFICACY OF ELECTRODE TEMPERATURE ON MICRODISCHARGES IN VACUUM

V.I. Gordienko and I.I. Pavlov

Soviet Journal of Technical Physics, Vol. 11, No. 2, pp 273-274 (08/1966).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 25, 374-376 (February 1966). The effect of the temperature of metal electrodes on the breakdown voltage in microdischarges in vacuum was investigated. It is shown that higher electrode temperature means higher threshold voltage (starting at 150-200 °C). Contamination of the electrode surface is considered as a possible cause. A significant difference in the nature of microdischarges is observed when hot cathodes are used. 1 Ref.

Primary Keywords: Microdischarge; Breakdown Voltage; Electrode Effect; Temperature Effect; Heated Anode; Heated Cathode

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7433
(PARTICLE BEAMS; ION)
(Generation)

NEW TYPE OF ACCELERATOR FOR HEAVY IONS
G.S. Jones, R.H. Levy, H.A. Botha and B.T. Field
Avco Everett Research Lab, Inc., Everett, MA 02149

Physical Review, Vol. 173, No. 3, pp 925-932 (05/1968).

A new device, called the heavy ion plasma accelerator (HIPAC) which will be capable of accelerating ions of atomic number to energies sufficient to overcome the nuclear Coulomb barrier, is described. A closed potential well is created by filling a toroidal vacuum chamber with electrons; the electrons are contained by a magnetic field whose intensity is so low that its effect on the ions can be neglected. Ions are both accelerated and trapped in the well. The trapping effect allows sufficient time for the ions to become highly stripped by electron impact. The very large ion energies that can be achieved in this way would allow a wide variety of nuclear reactions to be studied, including inverse fission. The present primitive state of development of the HIPAC is described, and the future prospects assessed. 51 Refs.

Primary Keywords: Ion-beam Generation; High Particle Ionization; Heavy Ion Plasma Accelerator; High Energy; Toroidal Geometry; Magnetic Field

Secondary Keywords: Nuclear Fusion

COPYRIGHT: 1968 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

7467
(PARTICLE BEAMS, ELECTRON)
(Generation)

PHYSICAL PROPERTIES OF THIN-FILM FIELD EMISSION CATHODES WITH MOLYBDENUM CONES
C.A. Spindt, J. Brose, L. Humphrey and E.P. Westerberg
Stanford Research Institute, Menlo Park, CA 94035

Journal of Applied Physics, Vol. 47, No. 12, pp 5248-5263 (12/1976).

Field emission cathodes fabricated using thin-film techniques and electron beam micro lithography are described, together with effects obtained by varying the fabrication parameters. The emission originates from the tip of molybdenum cones that are about 1.5 micrometers in tip radius around 500 Å. Such cathodes have been produced in closely packed arrays containing 10⁴ cones per square centimeter. Maximum current in the range 10-150 microampere per cone can be drawn with applied voltages in the range 140-300 V when operated in the constant-current mode at pressures of 10⁻⁹ Torr or less. In the arrays, current densities (averaged over the array) of above 10 A/cm² have been demonstrated. Life tests with the 100-cone arrays drawing 2 mA total emission (or 3 A/cm²) have proceeded in excess of 7000 h with about a 10% drop in emission current. Studies are presented of the emission characteristics and current fluctuation phenomena. It is tentatively concluded that the emission arises from only one or a few atomic sites on the cone tips. 57 Refs.

Primary Keywords: Electron Generation; Thin Film Cathode; Molybdenum Cones; 10 A/cm²; Current Densities; Cone Arrays

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7470
BASIC PRINCIPLES GOVERNING THE DESIGN OF MAGNETIC SWITCHES

D.L. Bixby, L.J. Lau, L.L. Reginato, J. Schmidt and M. Smith
Lawrence Livermore Lab, Livermore, CA 94550
(11/1980)

Availability: UCID-18831

The idea of using saturable reactors as the basis of high power pulse generators is not a new concept, but there have been few recent applications of this technology. Here the principle of magnetic pulse generation is briefly described and some of the basic guidelines used to design these circuits are discussed. A demonstration of the principles by a small scale pulse amplifier is presented, and finally there is an extension to a large scale system. (EPRA citation no. 06465)

Primary Keywords: Pulse Generators; Design; Operation
Secondary Keywords: FRDA-426800; NTIS01

7476
(CAPACITORS; CAPACITIVE)

HYDROMAGNETIC CAPACITOR

R. Anderson, H.K. Barker, A. Bratenahl, H.P. Furth and W.B.unkel

Lawrence Berkeley Lab, Berkeley, CA

Journal Of Applied Physics, Vol. 50, No. 2, pp 188-196 (02/1955). Very high dielectric constants can easily be achieved by means of a capacitor in a strong magnetic field. When an orthogonal electric field is applied, the resultant particle drift stores dielectric energy. In a coaxial capacitor, which makes use of a rotating plasma disk, dielectric constants in the range 1E6 to 1E8 have been measured. The potential usefulness of hydromagnetic capacitors in fast-discharge work is considered. 8 Refs.

Primary Keywords: Capacitor Design; Magnetically Confined Plasma; Dielectric Constant; Very High Density Capacitor

COPYRIGHT: 1955 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7485
(PULSE GENERATORS)

(Reviews)

PULSE POWER REQUIREMENTS FOR LASER ISOTOPE SEPARATION

P.N. Morse and W.L. Willis
Los Alamos National Lab, Los Alamos, NM 87545

1976 IEEE Thirteenth Modulator Symposium, pp 274-276 (06/1976). Laser systems being developed for laser isotope separation applications have pulse power requirements which will demand the ultimate capability of pulsed power technology. Although the energy per pulse is small by many pulse power standards, the requirement for currents in excess of 100 kA and a voltage of about 100 kV, and pulse repetition rates of 1 kHz constitute a set of requirements not previously imposed on pulse power systems. In this paper measurements made at low repetition rates on excimer laser discharges are presented, and the implications for pulse power components are discussed. Currently available switches and energy storage systems are discussed, and requirements for future development are given. 0 Refs.

Primary Keywords: Laser Loads; Pulsed Power Requirements; Switching; Energy Storage; Rep-rate

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

(PARTICLE BEAMS, ELECTRON)

(Transport)

EXTENDED WORKING RANGE FOR ELECTRON BEAMS IN THE ATMOSPHERE
J.F. Lowry and B.W. Schumacher
Westinghouse Research and Development Center, Pittsburgh PA

Nuclear Instruments And Methods 130, pp 577-596 (09/1975).

The range and the power density at a given work distance for a high power electron beam outside the vacuum depend upon a number of factors besides the beam voltage, for instance temperature (i.e., density) and composition of the atmosphere in which the beam travels. These factors were investigated experimentally. The heating of the air in the beam path by a high power beam itself can increase the range by as much as a factor of 2 and the power density at a given distance from the electron gun by a factor of 10. This heating of the gas can be enhanced by surrounding the beam path by a fairly wide guard-tube through which, in addition, helium may be flowed. Another way to create a high temperature low atomic number path for the beam consists of a coaxial hydrogen flame. With these devices we found the range could be extended by a total factor of 3, and the power density for a given total power increased by a factor of about 50. The results of the present measurements agree with earlier theoretical calculations, as far as applicable. We also found that the visible, fluorescent beam plume gives a misleading impression: it is much wider than the actual scatter-broadening of the high-energy electron component of the beam. 10 Refs.

Primary Keywords: Beam Propagation; Air; Parameter Study; Simulation; Numerical Calculation; Optimization

COPYRIGHT: 1975 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

(PARTICLE BEAMS, ELECTRON)

(Generation)

THE CURRENT IN A CYLINDRICAL RELATIVISTIC DIODE

N.W. Harris
Ion Physics Corp, Burlington, MA 01803Journal of Physics D: Applied Physics, Vol. 13, pp 789-792 (10/1979).
The current in a space-charge-limited cylindrical diode working at very high voltages has been calculated. The results are presented graphically for a wide range of electrode diameter ratios and for voltages up to 1 MeV. The results are given for the exterior cathode and interior cathode configurations. 9 Refs.

Primary Keywords: Diode; Space-charge-limited; Current Measurement; Several Electrode Diameters; Radially Convergent Beam

COPYRIGHT: 1980 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Liquid, Electrical)

THE EFFECT OF ORGANIC ADDITIVES ON THE BREAKDOWN AND GASSING PROPERTIES OF MINERAL OILS

A.A. Zaky, I.Y. Megahed and C. Evangelou
University of Alexandria, Alexandria, EgyptJournal of Physics D: Applied Physics, Vol. 9, pp 861-850 (11/1976).
The effect of organic additive content on the direct voltage breakdown strength of degassed transformer oil and liquid paraffin is reported for a wide range of concentration of additives known to be effective gassing initiators. The effect on the breakdown strength of oils saturated with hydrogen, nitrogen and oxygen is also reported. Measurements of the gassing properties of the oils were carried out for the same extended range of additive concentrations. The observed breakdown and gassing versus concentration characteristics indicate the presence of maximum and minimum points at concentrations which are independent of the matrix liquid and of dissolved gas and gas phase. There is a remarkable degree of correlation between the breakdown and the gassing properties of the liquids tested. This and other relevant observations indicate that gas generation is an intrinsic part of the breakdown process and strongly support the bubble theory of breakdown. This forms the basis for the discussion of the results. 20 Refs.

Primary Keywords: Organic Additives; DC Voltage; Degassed Oil;

Gas-saturated Oil; Gassing-breakdown Correlation

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Gas Gaps, Materials)

THE EFFECT OF ROTATING ARC VELOCITY ON COPPER CATHODE EROSION

A.E. Guile and A.H. Hitchcock
Leeds University, Leeds, U.K.Journal of Physics D: Applied Physics, Vol. 7, pp 597-601 (01/1974).
In a number of devices, transverse magnetic fields are used to rotate arcs to minimize electrode erosion. Measurements are reported here for 45° A arcs rotated at an arc velocity of 1 cm/s, which show that the cathode loss, which exceeds that of the anode, can be determined with good accuracy. An allowance is made for oxidation. These results, which have been reproduced over a much wider range of arc velocity than an arc velocity reported previously, show that the variation of cathode erosion rate with arc velocity is not a simple one, and that an abrupt fall or increase can occur for a very small change in arc velocity. Whereas it has commonly been assumed that increasing the magnetic field will continuously reduce the loss of electrode material, it is suggested that these considerable variations in cathode erosion are associated with changes in electron emission caused by differing oxide film conditions on the cathode surface. 23 Refs.

Primary Keywords: Rotating Arc; Magnetically Driven; Atmospheric Air; Low Current; Wide Air Velocity Range

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(SWITCHES, CLOSING; BREAKDOWN STUDIES)

(Vacuum Gaps, Electrical; Vacuum, Electrical)

THE EFFECT OF TEMPERATURE ON THE ELECTRICAL CHARACTERISTICS OF A VACUUM GAP

D.A. Swift
Central Electricity Research Lab., Leatherhead, Surrey, UKJournal of Physics D: Applied Physics, Vol. 5, pp 1588-1591 (05/1972).
An experiment has been done in which the electrodes of a vacuum gap were operated at widely different temperatures over a range 4 to 300 Deg. K. The temperatures of both the anode and cathode were found to affect the prebreakdown current and breakdown voltage of a 0.8 mm uniform field gap between molybdenum electrodes of industrial surface finish. 7 Refs.

Primary Keywords: Temperature Effects; 4-300 Deg. K Range; Prebreakdown Current; Breakdown Voltage; Uniform Field Gap; Molybdenum Electrodes

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(SWITCHES, CLOSING)

(Thyristrons)

THE HOLLOW THERMIONIC CATHODE SYSTEM USED IN THYRATRONS

J. Gower
MO Valve Co, London, UK

Journal of Physics D: Applied Physics, Vol. 3, No. 9, pp L57-L59 (07/1970).

A simple explanation for the high currents obtained from hydrogen thyratron cathodes is put forward. It is suggested that the 'hollowness' of the cathode structure and the high secondary emission coefficient for low energy hydrogen ions incident on barium covered surfaces leads to a self-maintained discharge with a modest running voltage. This static state does not explain the large amplitude oscillations (about 160 MHz) that have been observed in the cathode region of thyatrons during the first 0.2 microsecond of pulsed discharges. 3 Refs.

Primary Keywords: High Cathode Current; Analysis; Secondary Emission; Self-maintained Discharge

COPYRIGHT: 1970 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Gas, Electrical)

THE MECHANISM OF ELECTRICAL BREAKDOWN OF GASES, INITIATED BY A LARGE NUMBER OF ELECTRONS

P. Sulubeka and Reu. R.S.N.
Indian Institute of Science, Bangalore, India

Journal of Physics D: Applied Physics, Vol. 5, pp 2055-2063 (07/1972).

The mechanism of breakdown in uniform fields was investigated by humid air, dry air, oxygen, hydrogen and nitrogen at atmospheric pressure, using a large number of initial electrons (approximately 10¹²) emitted from the cathode as a delta function at the start of a high-voltage rectangular pulse applied to the discharge gap. The threshold breakdown voltages were about 30% higher than the DC breakdown voltages reported by others. The formative times at threshold and at overvoltages indicated that up to a critical overvoltage, breakdown takes place by the multiple-avalanche Townsend mechanism, due to a photoelectric secondary effect at the cathode. The magnitudes of the critical overvoltages were not significantly less than those with a single initial electron obtained by other workers. For overvoltages higher than the critical, there was a transition region, at the end of which, breakdown transforms to the single-avalanche streamer mechanism. 17 Refs.

Primary Keywords: Uniform Field; Several Gases; IEEE Initiating Electrons; Formative Time Log; Single-avalanche Streamer

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(SWITCHES, CLOSING)

(Gas Caps, Electrical)

THE PARALLEL OPERATION OF LOW-INDUCTANCE HIGH-CURRENT SPARK GAPS WITHOUT TRANSIT TIME ISOLATION

P.M. Berres, J.E. Gruber and T.E. James
Culham Lab., Bunting, Oxfordshire, UK

Journal of Scientific Instruments, Vol. 44, pp 599-605 (03/1971).

The necessary conditions for the satisfactory parallel operation of spark gaps, with no transit time isolation between them, are deduced theoretically. Such a capacitor, with closely connected parallel spark gaps has been operated successfully. The development of a 60 kV, 100 A, field-distortion spark with an inductance of 15-18 nH is described, and the influence of electrode arrangement and trigger circuit parameters on breakdown time and jitter has been investigated. 8 Refs.

Primary Keywords: Close Coupling; Field Distortion Gaps; Low-inductance; Variable Geometry; Variable Trigger Parameters; Experiment; Theory

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

TESTING AND ANALYSIS OF A FAST DISCHARGE HOMOPOLAR MACHINE (FDX)

J.M. Bullock, K. Zowarka, N.D. Diron, J.H. Gully, H.G. Rylander, K.M. Tolka, W.J. Uhlmann and R.W. Woodson

University of Texas at Austin, Austin, TX 78712

2nd IEEE International Pulsed Power Conference Proceedings, pp 333-342 (06/1979).

The Fast Energy Exchange Experiment (FDX) is a 0.36 MJ, 200 V homopolar machine designed to discharge in one millisecond. This experiment is intended to establish the fundamental limitations involved in extracting energy in the shortest time from a flywheel unit. FDX features room temperature 1.656 A-T copper coil pulsed by a 5 Ms slow discharge homopolar machine, two 30.5 cm diameter counter rotating aluminum rotors with flame sprayed copper slip rings, low inductance return conductors, coaxial transmission line, fast soft fast closing (30 microseconds) 1/2 MA making switches, hydrostatic journal bearings, -cuseza film thrust bearings and dual brush activation systems. After initial testing of FDX was completed and data was analyzed, problems limiting performance were identified. Various components of the machine were redesigned and modified to correct these problems. A second set of tests, including short circuit discharges from various speeds, has recently been conducted. Results and analysis of these tests will be presented. New problems encountered as well as recommendations for additional work will also be given. 4 Refs.

Primary Keywords: Homopolar Generator; Aluminum Rotor; Copper Slip Ring; Hydrostatic Journal Bearing; Analysis; Performance Limitations

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7498

(BREAKDOWN STUDIES)

(Liquid; Electrical)

ELECTRICAL CONDUCTIVITIES AND BREAKDOWN RESISTANCE OF MIXTURES OF SOME LIQUID DIELECTRICS UNDER VOLTAGE PULSES

Yu.A. Korsunovskii and A.A. Protopopov
Applied Electrical Phenomena, No. 4, pp 257-261 (08/1967).
Trans. From: Elektronnaya Obrabotka Materialov 4, 29-34 (July-August 1967).

Studies of the breakdown resistance of liquid dielectrics began long ago, but only in 1961 was it discovered by Ruhle that certain concentrations of some polar substances increased the breakdown resistance of n-hexane to an alternating voltage of frequency 50 cps. Goryang and co-workers observed an increase of 30% in the breakdown resistance of n-hexane with an admixture of 5% ethyl alcohol. This result was obtained for a constant voltage. Kao and Higman established that the addition of 5% carbon tetrachloride, chlorobenzene, chloroform, or ethyl alcohol increased the breakdown resistance of n-hexane, measured for voltage pulses, by 35%, 28%, 13%, and 7%, respectively. Electrical conductivities and breakdown resistances of mixtures of carefully purified n-hexane with octane, benzene, m-xylene, chlorobenzene, chloroform, and carbon tetrachloride were studied as functions of the concentrations of these solutes. Measurements of electrical conductivity in pre-breakdown fields and breakdown resistance were carried out with voltage pulses of rectangular shape and 6 microsecond durations, isolated pulses being used. Analytical grade and chemically pure materials were used as solutes, being filtered through a No. 3 glass filter. 5 Refs.

Primary Keywords: Liquid Dielectrics; N-hexane; Mixture; Polar Dielectrics; Non-Polar Dielectric; Parallel-plane Electrodes; Short Gap

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

7503

(ENERGY STORAGE, MECHANICAL)

(Rotating Machines; Materials)

ROTATING GEAR FOR HIGH CURRENT PULSES AND HIGH RUBBING VELOCITIES

P.A. Marshall
Australian National University, Canberra, Australia
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-85, No. 11, pp 1177-1187 (11/1966).

This paper describes the mechanical brush gear designed for carrying the 1.6 million-ampere 1-second pulses from the rotors of the Canberra homopolar generator. Current density in the copper-graphite brushes rises to about 10000 A/sq. in. at full current. The brushes are also required to operate at rubbing speeds of up to 3500 f/min. The experiments that were made to set the design limits for the brushes and the results obtained from these experiments are described. The design requirements and details of the brush gear as manufactured are given, and their operation in the homopolar generator is discussed. 7 Refs.

Primary Keywords: Homopolar Generator; Brush Gear Design; 10 kA/sq. in. Brush Current Density; 33000 ft/min Rubbing Velocity; Performance Test

COPYRIGHT: 1966 IEEE, REPRINTED WITH PERMISSION

7506

(BREAKDOWN STUDIES)

(Gas; Electrical)

DEVELOPMENT OF OVERVOLTAGE BREAKDOWN AT HIGH GAS PRESSURE

E.E. Kunkel and W.H. Bussozzi
Texas Tech University, Lubbock, TX 79409
Physical Environ. A, Vol. 21, No. 6, pp 2069-2077 (06/1980).

A model for the development of electrical breakdown in dense gases is presented. It describes the initial phase of breakdown in the regime where the Townsend avalanche mechanism does not apply. The main features of the model are as follows: (1) It gives a continuous picture of the development both in the structure of the breakdown and the physics of the processes, and (2) it is based on electron kinetics, so that the theory is general in scope. In light of this model a brief discussion of experimental results is given. 25 Refs.

Primary Keywords: Gas Breakdown; High Pressure Gas; Ionization; Avalanche; Streamer Theory; Theory; Electron Kinetics

COPYRIGHT: 1980 THE AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

7508

(BREAKDOWN STUDIES; SWITCHES; OPERATING)

(Exploding Wires; Explosives)

EFFECTS OF SURROUNDING MEDIUM ON ELECTRICALLY EXPLODED ALUMINUM FOIL

T.L. Berger
Naval Surface Weapons Center, Dahlgren, VA 22448

IEEE Transactions On Plasma Physics, Vol. 20, No. 3, pp 213-216 (09/1982).

Aluminum foil foils were exploded electrically by discharging a capacitor bank into a series combination inductance (approximately 600 nH) and foil. The 2.54 x 2.54 x 0.021 cm foils were exploded in a sealed chamber. The time-to-burst (T_{2B}) and fuse voltage characteristics were investigated as a function of the fuse environment. Results are given for foils exploded in various gases and liquids. 17 Refs.

Primary Keywords: Aluminum Foil; Fuse; Environmental Effects; Several Tapes; Several Liquids; Fuse Voltage vs Time

COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

7509

(BREAKDOWN STUDIES)

(Vacuum; Electrical)

ELECTRICAL BREAKDOWN IN HIGH VACUUM

W.S. Boyle, P. Kinsella and L.M. Cormier
Bell Labs, Murray Hill, NJ 07941

Currents produced by breakdown have been measured between closely spaced tungsten electrodes over a high vacuum. It is found that field-emission currents sufficient to prevent an air-water flow before breakdown increase the yield of the first breakdown event when the field magnitude is due to surface irregularities on the cathode is taken into account. The field configuration is a function of distance at electrode separation less than 46.4 cm. Ignition of the observed breakdown at low voltage and small spacing requires an unusually high yield of electrons at the cathode per unit forced in the gap. Furthermore, there is no measurable direct enhancement of the current by ion drift over the higher voltages. The high electron yield must therefore be explained over the entire observed range of breakdown voltage. The ion yield is satisfactorily accounted for by the increase in ion current due to the gas flow ion source charge, which in turn increases the retarding ion current density until there is breakdown. It is shown that breakdown occurs when the field magnitude is increased by only 5% beyond that for which the current is reduced with the ion current density much smaller than the electron current density. 9 Refs.

Primary Keyword: Breakdown Current; Ionization; Electrodes; Field Emission; Aging; Emissivity; Ion Flow; Viscous Equation

COPYRIGHT: 1975 AMER PHYSICAL SOC, 0018-9197/75/030202-05\$01.00

REPRINTED WITH PERMISSION

7515

(BREAKDOWN STUDIES)

(Liquid; Electrical)

EXPERIMENTS ON ELECTRICAL BREAKDOWN IN WATER IN THE MICROSECOND REGIME

D.B. Farneman and R.J. Grishaver
Naval Surface Warfare Center, Dahlgren, VA 22448

IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 209-213 (09/1980).

This paper presents experimental results from research on electrical breakdown in water carried out at NSWC/DL. The experimental apparatus is described in some detail. Results from approximately two thousand tests are presented. Breakdown events were observed predominantly in the 2-10 microsecond regime for applied fields in the range 150-500 kV/cm. The shot-to-shot variation of breakdown time intrinsic to the phenomena requires statistical measures of performance. The performance of four electrode materials—copper, brass, stainless steel, and aluminum—is presented. The first three performed similarly; aluminum was significantly different. 1 Ref.

Primary Keywords: Water Breakdown; 2000 Breakdowns; Microsecond Pulse; Copper Electrode; Brass Electrode; Stainless Steel Electrode; Aluminum Electrode; 500 kV/cm E-field

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

7543

(BREAKDOWN STUDIES)

(Explosive Wires)

CHARACTERISTICS OF ENERGY RELEASED IN A CHANNEL FORMED BY AN EXPLODING WIRE

V.N. Ocherten
FSTC Report No. FSTC-HT 23 131-74 (05/1974).

Trans. From: Elektronnaya Obrabotka Materialov 3, 74-75 (1974).

Availability: AD A035:59 NTIS

A theoretical study is made of the conditions for energy release in a wire channel by an exploding wire, at which the maximum power is successfully obtained. It was found that the energy density in the channel is determined mainly by the magnitude of the discharge current and the discharge channel radius, and that the energy density is greater in materials with greater magnetic permeability, i.e., steel or iron, rather than copper, aluminum or brass. The study showed that the skin effect can be disregarded. The curve of the instantaneous power given off in the channel can be plotted from current and voltage oscilloscopes, and the equations used show that microsecond capacitive capacitors are preferable to low-voltage, high-capacitance capacitors. It is shown that the pressure at the channel boundary can be determined, which permits proceeding to calculation of the hydrodynamic pulse parameters. 5 Refs.

Primary Keywords: Exploding Wire; Plasma Channel; Theory; Numerical Calculations; Dependence On Current Magnitude; Dependence On Wire Material

7546

A STUDY OF POWER AND ENERGY IN THE AURORA MODIFICATION PROJECT

J.D.J. Shippen
Naval Research Lab, Washington, DC 20375

Final Rep. No. NNL-TR-4781, 26p (07/1980).

Availability: AD-A158 051/8 NTIS

This report summarizes the results of a series of computer runs at NPL which were designed to determine if the measured loss of power and energy in the Aurora Modification Project tests in the Fall of 1978 was due to increasing capacitance in the water switches during the transit times of the streamers or was due to resistive losses in the water switches. From the results of these analyses, it is concluded that the losses were mainly due to resistance in the intermediate store and pulse forming liner output switches and that the changing switch capacitance mainly rounded the pulse shapes near the peak values without contributing to a major loss of energy. It is suggested that all switches be considered as a replacement for the water switches since they may have less loss, although there are risks and problems involved in their use. (Author) 4 Refs.

Primary Keywords: Pulse Generators; Electromagnetic Pulses; Electronic Switches; Transmission Lines; Computations; Computer Applications

Secondary Keywords: Aurora; Gamma Ray Facility; Nanosecond Time

7557

(MEETINGS AND CONFERENCES; ENERGY STORAGE; POWER CONDITIONING; SWITCHES)

(Conferences; Reviews; Reviews)

W.G. Lutjens (Ed.), S.T.C.P.A./I. COMPRESSION, AND SWITCHING

W.G. Lutjens (Ed.), V. Hardi (Ed.), (1) and 0.5.F. Zucker (Ed.) (2)

Int'l Conf. On Industrial Technology, Hoboken, NJ 07030

Int'l Conference Lab, Livermore, CA 94550

Publisher: Plenum Press, New York and London (01/1976).

The papers contained in this conference record encompass several aspects of energy storage and compression, switching, particle beam generation and plasma physics. Pulsed power systems for the generation of e-beams are presented in several papers, as is the use of collective effects for ion acceleration. The plasma focus is considered as both a plasma device and as a source of e-beams. Flux compression is considered both as a source of electrical power and as a means of producing intense magnetic fields. Capacitive and inductive energy storage systems are, of course, well represented. Several kinds of closing switches and exploding wire opening switches are considered in some detail. 654 Refs.

Primary Keywords: E-beam Generation; Collective Effects; Capacitive Energy Storage; Inductive Energy Storage; Homopolar Generator; Thyristor; Gas Spark Gap; Oil Spark Gap; Exploding Wire

COPYRIGHT: 1976 PLenum Press, REPRINTED WITH PERMISSION

7561
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
(Solid, Electrical; Solid)

ELECTRODE-LIMITED AND SPACE-CHARGE-LIMITED TRANSIENT CURRENTS IN INSULATORS

S.Z. Weiss (1), A. Cobas (1), S. Trestor (2) and A. Many (3)
(1) Puerto Rico Nuclear Center, San Juan, Puerto Rico
(2) University of Puerto Rico, Rio Piedras, Puerto Rico
(3) Hebrew University, Jerusalem, Israel

Journal of Applied Physics, Vol. 39, No. 5, pp 2296-2302 (04/1968).

The equations governing the transient-current flow in insulating crystals are solved for two categories of boundary conditions corresponding to situations in which the current is partly space-charge controlled and partly electrode limited. The carrier-reservoir at the injecting electrode is assumed to arise from photoexcitation by a pulse of highly absorbed light. In one category, the light intensity is taken to be sufficiently strong such that initially the current is completely space-charge limited. The time dependence of the current after the collapse of the carrier reservoir is calculated. With the time interval elapsed between the onset of the light pulse and the resumption of current taken as a parameter, the other category is considered. Correspondingly, a sufficiently weak pulse excites the field at the illuminated electrode never zero. The duration of the pulse for this category is assumed to be short compared to the carrier transit time. The time and voltage dependence of the current is calculated in this case in the presence of surface recombination. Both categories of boundary conditions are often encountered in practice, and a comparison between theory and experiment is expected to yield valuable information on carrier generation and recombination processes at the surface. 9 Refs.

Primary Keywords: Insulating Crystal; Space Charge Limited Current; Electrode Limited Current; Electrode Illumination

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7568
GENERATING HIGH VOLTAGE PULSES BY INTERRUPTING CURRENT IN AN INDUCTIVE CIRCUIT

M. Friedman and M. Ury
Naval Research Lab, Washington, DC 20375
Interim rep. No. NRL-MR-3326, 14p (07/1976).
Availability: AD-A028 075/057 NTIS

A new approach to the problem of developing an opening switch for inductive systems is described. The switch (fuse) consists of an aluminum foil immersed in water. Heat transfer processes and chemical reactions between the Al and Water determine switch performance. Six kilojoules of electrical energy was handled by the switch and voltages of up to 130 kV were generated across the switch electrodes. (Author)

Primary Keywords: Pulse Generators; Interrupters; Electric Switches; Inductors; Energy Storage; High Power; Fuses(Electrical); Aluminum; Foils(Materials); Immersion; Water; Heat Transfer; Chemical Reactions Electric Power

Secondary Keywords: Inductive Storage: NTISDCDXA

7570
(ENERGY STORAGE, INDUCTIVE; POWER CONDITIONING)
(Inductors; Pulse Transformers)

HALF-MEGAPIERE MAGNETIC-ENERGY-STORAGE PULSE GENERATOR
R.C. Walker and H.C. Early
University of Michigan Research Institute, Ann Arbor, MI
The Review of Scientific Instruments, Vol. 29, No. 11, pp 1020-1022 (11/1958).

Energy is stored in the magnetic field of a large air core transformer having a very low impedance, tightly coupled secondary winding. The energy can be effectively delivered in less than 5 msec to a noninductive load having a resistance of less than 1E-4 ohm. 2 Refs.

Primary Keywords: Pulse Transformer; Inductive Energy Store; Resistive Load; 5 ms Pulse Length

COPYRIGHT: 1958 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7574
(PULSE GENERATORS; ELECTROMAGNETIC LAUNCHERS)

(Rotating Machines; Railguns)
HOMOPOLAR CURRENT SOURCE FOR MASS ACCELERATORS
I.M. Vitkovitsky, R.D. Ford, D. Jennings and W.H. Lupton
Naval Research Lab, Washington, DC 20375

IEEE Transactions On Magnetics, Vol. MAG-18, No. 1, pp 157-159 (01/1982).

Acceleration of sub-millogram mass to velocities of several km/s by magnetic forces requires a multi megajoule source of energy. Constraints associated with the long time constant of air and with the structural integrity of the accelerated mass as well as with the problem of contact erosion, break down, and accelerating time and current to the millisecond and microseconds regimes, respectively. Homopolar generators, if combined with appropriate switching can provide such output pulses more economically than other sources. 11 Refs.

Primary Keywords: Magnetic Accelerator; Rail Gun; Contact Breakdown; Mass Accelerator; Current Pulse; Homopolar Generator; Transfer Switch

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

7576
(PARTICLE BEAMS, ELECTRON)

(Generation)
IMPEDANCE CHARACTERISTICS OF DIODES OPERATING IN THE SELF-PINCH MODE
G. Cooperstein and J. Gurdon
Naval Research Lab, Washington, DC 20375

Journal of Applied Physics, Vol. 46, No. 4, pp 1535-1538 (04/1975).

The impedance characteristics of large aspect ratio diodes employing hollow field emission cathodes operating in the self-pinch mode have been studied at electron kinetic energies between 400 and 800 kev and currents between 100 and 500 A. The importance of correcting the anode-cathode gap spacing for closure due to plasma motion is recognized and taken into account in the definition of the diode aspect ratio in impedance calculations. With this correction, the impedance at peak diode voltage and current is found to be near $\sqrt{2}$ independent of voltage and cathode surface area, and inversely proportional to the diode aspect ratio. Its amplitude is approximately 50% higher than that predicted by paraboloidal flow theory. 12 Refs.

Primary Keywords: Field Generation; Field Emission Diode; Carbon Cathode; Self-Pinch Cathode; Beam Pinch; Large Aspect Ratio Diode

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7580
(PARTICLE BEAMS, ELECTRON)
(Generation)

INTENSE FOCUSING OF RELATIVISTIC ELECTRONS BY COLLAPSING HOLLOW BEAMS

A.E. Pinduff and G. Cooperstein
Naval Research Lab, Washington, DC 20375

Physical Review Letters, Vol. 34, No. 8, pp 461-464 (02/1975).

Low-impedance diodes with hollow tapered cathodes produce strong self-pinchings in intense relativistic electron beams. Early in the pulse a thin hollow beam is formed, based on evidence of electrons striking the anode. This hollow beam collapses, accelerating toward the anode axis with velocities (1 to 5 mm/sec) which depend locally on the anode material. An efficient and stable pinch, less than 3 mm in diameter, is formed at the anode. In the center 0.1 sq.cm., the power rises to 1000 W in less than 3 nsec. About 50% of the total diode energy (approximately 9 kJ) is dissipated within the pinch region. 8 Refs.

Primary Keywords: E-beam Generation; Hollow Cathode; Tapered Cathode; Hollow Beam; Beam Pinching; Anode Material

COPYRIGHT: 1975 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

7582
(BREAKDOWN STUDIES)

(Vacuum, Optical)

EVIDENCE FOR REVERSE PHOTOELECTRONS IN LASER-INDUCED CURRENT

S.P. Brody
University of Oxford, Oxford, UK

Journal of Applied Physics, Vol. 43, No. 1, pp 244-245 (01/1972).
Stimulated-particle evidence has been obtained for the significant contribution of 'reverse photoelectrons' in the production of current signal induced by focusing laser light onto a metal target and biasing the collector negative with respect to the target. Reverse photoelectrons are essentially normal photoelectrons from the collection region. The source of these photons is the laser-produced hot spot on the target. 6 Refs.

Primary Keywords: Photoelectrons; Laser Irradiated Anode; Thermal Radiation; Cathode Photemission

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7583
(PARTICLE BEAMS, ELECTRON)

(Generation)

INTERACTION OF ACCELERATING HIGH-CURRENT ELECTRON BEAMS WITH EXTERNAL MAGNETIC FIELDS

D.A. Hammer (1), W.F. Oliphant (1), I.M. Vitkovitsky (1) and V. Fargo (2)

(1) Naval Research Lab, Washington, DC 20375

(2) Lockheed Missile And Space Co., Palo Alto, CA 94305

Journal of Applied Physics, Vol. 43, No. 1, pp 58-60 (01/1972).
When the current and current density of electrons accelerated in the anode-cathode gap of a field-emission tube reach sufficiently high values, the induced self-magnetic field begins to dominate the electron trajectories. As a result, the spatial distribution of electrons leaving the anode becomes strongly peaked in the center of the anode. It has been found possible to prevent such beam collapse with relatively modest external magnetic fields. The field is applied parallel to the electron flow (perpendicular to the anode plane). A scaling law which determines the necessary field strength based on a simple orbit model is found to agree with experimental results over a wide range of electron-beam parameters. 8 Refs.

Primary Keywords: E-beam Generation; Field-Emission Diode; Self-magnetic Field; Beam Collapse; External Magnetic Field

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7584
(BREAKDOWN STUDIES)

(Gas, Optical)

GAS BREAKDOWN IN TH 10.6-MICRON-WAVELENGTH CO/SUB 2/ LASER RADIATION

DC Smith
United Aircraft Research Labs, East Hartford, CT 06118

Journal of Applied Physics, Vol. 43, No. 11, pp 4501-4505 (10/1972).
The gas breakdown threshold or the minimum power density required to ionize a gas with 10.6-micron-wavelength radiation has been examined using the criterion of a g-switched CO₂/ laser. The studies show that the focused beam cannot initiate the breakdown process for intensities as high as 10⁹ W/cm². If an initial low dose of ionization is provided by an external source, the subsequent growth of the breakdown is in agreement with a cascade model, as evidenced by the experimentally determined gas pressure and laser wavelength frequency dependence. 17 Refs.

Primary Keywords: Gas Breakdown; CO₂/Laser; Breakdown Threshold; Argon Gas; Cascade Model

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7587
(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Gas; Electrical; Gas)

IMPAUSE VOLTAGE TESTS ON AIR AND CO/SUB 3/ F/SUB 8/

L.C. Whitman

South Dakota State University, Brookings, SD

IEEE Transactions On Electrical Insulation, Vol. EI-1, No. 2, pp 44-48 (11/1965).

There is continual need for the evaluation of the electric strength of the various new gases that are becoming available and their comparison with the electric strength of some standard such as air. The electric strength of a new gas is not easily and quickly determined, yet it is essential in the proper design of equipment using these gases. It is the purpose of this paper to describe briefly the equipment that was used for this impulse voltage testing work and to record some impulse voltage breakdown data on carbon dioxide propane (CO₂/F₂) and its comparison to air. 5 Refs.

Primary Keywords: Air Breakdown; CO₂/F₂ Breakdown; Electric Strength Comparison; Test Apparatus Description

COPYRIGHT: 1965 IEEE. REPRINTED WITH PERMISSION

(SWITCHES, CLOSING)

(Liquid Gaps, Self)

MULTIPLE CHANNEL SWITCHING IN WATER DIELECTRIC PULSE GENERATORS

J.K. Burton, D. Conte, W.H. Lupton, J.D. Shipman Jr. and I.M.

Vitkovitsky

Naval Research Lab, Washington, DC 20375

1973 IEEE Proceedings Of The Fifth Symposium On Engineering Problems Of

Fusion Research Conference Record, pp 679-683 (11/1973).

Criteria have been developed for multiple channel switching without triggering of water dielectric pulse power systems. The channel-to-channel jitter time, the current partition between channels, and the mechanical integrity of the switch have been determined for switching high voltage pulse lines at energies up to 30 kJ. The operation of switches has been compared for voltages applied for 100 and 600 nsec. The results can be projected to the design of 1E13 W pulse generators. 12 Refs.

Primary Keywords: Self-triggered Water Switch; Multichannel Operation; Performance Test; Jitter; Current Sharing

COPYRIGHT: 1974 IEEE. REPRINTED WITH PERMISSION

(SWITCHES, OPENING)

(Mechanical)

NEW TYPE OF ULTRAFAST CIRCUIT BREAKER: ITS PRINCIPLE AND PERFORMANCES

P. Caupens, C. Rioux and F. Rioux-Damiau

Lab d'Electrotechnique, Orsay, France

The Review Of Scientific Instruments, Vol. 52, No. 1, pp 118-122 (01/1981).

The replacement of conventional voltage sources by inductive storage techniques in high-voltage pulse generation requires the successful operation of a suitable circuit breaker. The proposed device is composed of two different parts: the mechanical switch and the energy absorber. The magnetically activated mechanical switch operates in nitrogen under pressure and requires a low command energy (fix-1% of the primary stored energy). We present the mechanical switch basic principle and its performances, namely its restriking voltage and the parameters which affect it. The complete circuit breaker (switch plus energy absorber) can be used to open successfully currents up to 70 kA in times less than 10 microseconds. The restriking voltage ($t_{\text{rest}} = 40 \text{ kV}$ after 20 microseconds) is proportional to the number of knives and can be improved by having longer conductors and a large number of knives. The switch jitter is very low (approximately 1 microsecond). 12 Refs.

Primary Keywords: Mechanical Opening Switch; Inductive Energy Store; Nitrogen Working Gas; Magnetic Activation; Performance Test; 70 kA Opening Current; 40 kV Operating Voltage

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES; SWITCHES, OPENING)

(Exploding Wires; Explosive Fuses)

RECOVERY CHARACTERISTIC OF EXPLODING WIRE FUSES IN AIR AND VACUUM

I.M. Vitkovitsky and V.E. Scherrer

Naval Research Lab, Washington, DC 20375

Journal Of Applied Physics, Vol. 52, No. 4, pp 3012-3015 (04/1981).

The dielectric strength of exploded wire fuses during the vaporization and after recovery period and fuse resistivity are functions of time and depend on the medium surrounding the fuse channel. When fuses are used as opening switches in inductive storage systems, the above parameters determine the efficiency of power flow from the storage to the load. Specifically, design of experiments using loads with variable impedance, such as imploding plasma, required detailed information on the fuse characteristics during the time when the load impedance is changing. To provide data that determine the interaction of fuses with variable impedance loads, inductive and recovery electric fields and fuses resistivity in air and vacuum were studied. The results show that inductive field amplitude follows the dependence on time needed to vaporize the fuse in a manner similar to that established for fuses in other media. The characteristics of recovery rates of fuses in air and vacuum differ drastically due to the early onset of ionization in fuse channels in vacuum. 19 Refs.

Primary Keywords: Exploding Wires; Vaporization Stage; Recovery Stage; Dielectric Strength; Load Considerations

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(PARTICLE BEAMS, ELECTRON)

(Generation)

RELATIVISTIC ELECTRON SEAM PINCH FORMATION PROCESSES IN LOW IMPEDANCE DIODES

A.E. Blauggund (1), G. Cooperstein (1) and S.A. Goldstein (2)

(1) Naval Research Lab, Washington, DC 20375

(2) University of Maryland, College Park, MD 20742

The Physics Of Fluids, Vol. 20, No. 7, pp 1185-1194 (07/1977).

The process of pinch formation in large aspect ratio diodes has been studied by means of streak photography and time-resolved x-ray detectors. A tight pinch is formed at the anode center by a collapsing thin hollow electron beam emitted from a hollow cathode. The collapse velocity depends, amongst other things, on the type of material and on the micron layer of the anode. In the suggested model it is assumed that the anode plasma is created from gases released from the surface layer of the anode by the heating action of the beam. These gases are ionized by avalanche breakdown due to primary, backscattered, and secondary electrons. Ions emitted from this plasma modify the electron trajectories in the diode leading to a radial collapse of the hollow electron beam. The observed monotonic dependence of the collapse velocity on the atomic number of the anode material can be explained by the smooth dependence on Z of both the specific heat and the electron backscatter coefficient. In the case of high-Z anodes the ion expansion time is calculated and shown to be the factor limiting the collapse velocity. The use of thin foils to speed up the collapse rate is suggested. Detailed experimental data are presented. 23 Refs.

Primary Keywords: E-beam Generation; Hollow Cathode; Beam Pinching; Anode Effects; Anode Plasma; Thin-foil Anode

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

THE DQ SWITCH OPERATION AT 4 MILLION VOLTS AND 800 KILOAMPERES

J.W. Douglas, W.F.J. Cawson and C.H. Jones Jr.

Pulsar Associates Inc, San Diego, CA 92121

DNA Report No. DNA 5160F (12/1979)

Availability: DNA 5160F

NTIS

This report describes the progress to date with high voltage gas switching using the DQ switch developed by Pulsar Associates Incorporated. Self-breaking operation has been achieved at 4 million volts and 800 kiloamperes. Triggered operation has been achieved at 2 million volts. The control of insulator tracks is described, along with the engineering of the switch. 6 Refs.

Primary Keywords: DQ Switch; Gas Gap; Trigatron; Multi-section; UV Illumination

Secondary Keywords: Casino Simulator

(PULSE GENERATORS; SWITCHES, CLOSING)

(Blumlein Lines; Solid Dielectric, Electrical)

TRAVELING WAVE EXCITATION OF HIGH POWER GAS LASERS

J.D. Shipman Jr.

Naval Research Lab, Washington, DC 20375

Applied Physics Letters, Vol. 19, No. 1, pp 3-4 (01/1967).

Experiments are described in which nitrogen and neon lasers are excited by wave of current excitation which effectively travels from one end of the laser to the other with its velocity matching that of the stimulated emission. This type of excitation is accomplished with low-impedance flat-plate Blumlein pulse generator. The power output in the direction of the wave of excitation is at least ten times that in the other direction. A 2.5-mw pulse of about 4-nsec duration is obtained with nitrogen and a 190-mw pulse of about 1.5 nsec with neon. 5 Refs.

Primary Keywords: Blumlein Line; Solid Dielectric Switch; Travelling Wave; 4 ns Pulse Length

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1957 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Exploding Foils)

CALCULATION OF HEATING AND BURST PHENOMENA IN ELECTRICALLY EXPLODED FOILS

J.D. Logan, R.S. Lee, R.C. Weingart and K.S. Yee

Lawrence Livermore Lab, Livermore, CA 94550

A model is presented for calculating the transient temperature distributions in electrically exploded foils. The model employed is applicable up until the time of burst. Calculations are presented for Al, Cu, and Au foils showing good agreement with experimental current waveforms and burst times over a wide range of capacitor-bank charging voltages and for varying foil cross sections. The two-dimensional nature of the calculation permits investigation of effects associated with nonuniform heating of the foil and gives an estimate of the simultaneity of burst. 33 Refs.

Primary Keywords: Exploding Foils; Aluminum Foil; Copper Foil; Gold Foil; Current Calculation; Current Distribution; Temperature Distribution; Theory; Comparison With Experiment

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

ELECTRICAL BREAKDOWN OF A POINT-PLANE GAP IN HIGH VACUUM AND WITH VARIATION OF PRESSURE IN THE RANGE 1E-7 - 1E-2 TORR OF AIR, NITROGEN, HELIUM, SULPHUR HEXAFLUORIDE, AND ARGON

R. Hocken and G.R. Govinda Raju

University of Sheffield, Sheffield, UK

Journal Of Applied Physics, Vol. 45, No. 1, pp 4784-4794 (11/1974).

The DC breakdown potential of a point-plane electrode configuration is measured in high vacuum (approximately 1E-7 Torr) using the positive and the negative voltage polarity of the point electrode as a function of gap separation. Air, nitrogen, helium, sulphur hexafluoride, and argon are used in turn to alter the electrode-gas adsorption of various gases in high vacuum. It has been found that helium gives the highest breakdown voltage at a given gap length in high vacuum. It has also been found that very high breakdown potential values are obtained using positive-point-negative-plane electrodes (90 kV at 0.3 mm gap length, helium at 1E-7 Torr). The effect of AC (50 Hz) glow discharge conditioning on the dielectric strength of the gap is investigated and found to give considerable improvement in the voltage that the gap can withstand before a vacuum breakdown occurs. The effect of introducing various gases in the pressure range 1E-7 - 1E-2 Torr on the breakdown potential of point-plane gaps is investigated. Maxima are observed in the breakdown voltage and pressure curves in the range of 1E-4 - 1E-3 Torr. Helium and nitrogen give the highest breakdown voltage of about 90 kV for a gap length of 0.2 mm at about 1E-2 Torr. The observed improvements in the breakdown potential that the gap can withstand with certain gases are attributed to the increase in the work function of the combined metal-gas system. 74 Refs.

Primary Keywords: DC Breakdown; Gas Adsorption; Positive-point Gap

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Gas, Electrical)

EXPERIMENTAL STUDY OF THE PROPAGATION OF AN IONIZING WAVE IN A COAXIAL PLASMA GUN

J.M. Wilcox, E. Pugh, A. Datner and J. Eninger

Royal Institute of Technology, Stockholm, Sweden

The Physics Of Fluids, Vol. 7, No. 11 (Supplement), pp 551-556 (11/1964).

A coaxial plasma gun experiment is described. The gun has an azimuthal bias magnetic field, which is strong compared to the field from the discharge current. The discharge voltage is shown to depend linearly on the bias field, thus defining a velocity that is found to be almost independent of the pressure and the discharge current. This velocity is close to the 'critical velocity' which has been found in rotating-plasma experiments. The velocity of the current layer is also measured; it is always smaller than or equal to the critical velocity and it decreases with increasing pressure and decreasing magnetic field.

Primary Keywords: Plasma Gun; Ionizing Wave; Ionization; Magnetohydrodynamics; Bias Magnetic Field; Current Sheet; Critical Velocity

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7665
(BREAKDOWN STUDIES)
(Surface Flashover)

HIGH SPEED PHOTOGRAPHY OF SURFACE FLASHOVER IN VACUUM
J. D. Gross
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 3, pp 145-149 (06/1978).

The method and results of high speed streak photography of surface flashover in vacuum are presented. It is shown that the bright phase of the flashover arc bridges at 12.5 mm gap in 0.15 ns. The streak records indicate that the flashover arc is preceded by an intense electron burst from the cathode-insulator junction. 7 Refs.

Primary Keywords: Surface Flashover; Streak Photography; Bright Phase; Cathode-insulator Junction; Electron Burst

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7666
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

HOMOPOLAR GENERATOR EFFECT OF SUDDEN SHORT CIRCUIT

A. K. Das Gupta
Regional Engineering College, Rourkela, Orissa, India
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-87, No. 3, pp 655-659 (03/1968).

The effect of a sudden short circuit on a homopolar generator is analyzed and the transient time constant is deduced. The effect of non-uniform air gap is also considered. It is shown that the time constant of a machine with a very small air gap and thick cylinder is quite large, while the time constant of a thin cylinder machine with a larger air gap is small. 11 Refs.

Primary Keywords: Homopolar Generator; Load Short Circuit; Air Gap; Cylinder Thickness; Machine Time Constant

COPYRIGHT: 1968 IEEE. REPRINTED WITH PERMISSION

7672
(PARTICLE BEAMS, ELECTRON)
(Generation)

MAGNETIC CUTOFF IN HIGH-CURRENT DIODES

J.M. Creedon
Physics International Co., San Leandro, CA 94577
Journal Of Applied Physics, Vol. 48, No. 3, pp 1070-1077 (03/1977).

The process of magnetic cutoff in diodes is investigated for several geometrical configurations. Generalized coordinates are used to show that the cutoff mechanism has certain basic properties which are common to all of the configurations considered. Theoretical solutions for two different one-dimensional flow patterns are compared and shown to have similar mathematical properties.

Measurements are compared to theory for several types of magnetic cutoff. 21 Refs.

Primary Keywords: Field Emission Diode; Transmission Line; Magnetic Cutoff; Load-limited Cutoff; Theory; Numerical Calculation

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7678
(BREAKDOWN STUDIES)
(Gas, Electrical)

PRESSURE DISTRIBUTION IN THE STRUCTURE OF A PROPAGATING CURRENT SHEET
T.M. York (1) and R.J. John (2)

(1) Pennsylvania State University, University Park, PA

(2) Princeton University, Princeton, NJ

The Physics Of Fluids, Vol. 13, No. 5, pp 1303-1309 (05/1970).

The structure of the current sheet in a dynamic z pinch in argon is studied with a specialized high speed piezoelectric pressure transducer capable of following profiles of electric and radial pressure with time resolution. Comparison of the data with electrical and magnetic field profiles, luminosity, and voltage records, indicates three distinct zones within the sheet in sequence: regions of electron current conduction, mass accumulation with ion current conduction, and induced flow of unswept gas. Profiles of particle density, velocity, and temperature are evaluated on the basis of a simplified gas-kinetic model. The current sheet is found to entrain a large percentage of the gas encountered, and a momentum balance across the sheet is in approximate agreement with snowplow predictions, but the distributions of current and mass density differ categorically from conventional piston-sheath wave models. 9 Refs.

Primary Keywords: Z-pinch; Current Sheet; Electron Temperature; Plasma Density; Pressure Measurements; Self-magnetic Field

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7685
(BREAKDOWN STUDIES)
(Exploding Wires)

RESISTANCE AND ENTHALPY OF REFRactory EXPLoding WIRES

M.M. Martynov, T. Kirirkhodzhanov and V.I. Tsapkov
Patrice Lumumba University of International Friendship, Moscow, USSR

Soviet Physics-Techical Physics, Vol. 19, No. 11, pp 1458-1461 (05/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 64, 2367-2373 (November 1974). A pulsed resistive probe method has been used to measure the relative electrical resistance divided by R_{sub}/R as a function of the enthalpy H for Zr, Hf, Nb, Mo, W and Pt as the wire samples are heated by current pulses with $I_{\text{sub}}/I = 1/400-500$ and 30-35 microseconds. In the prolonged heating the samples are ruptured immediately after melting; with a brief heating, there is a deeper penetration into the liquid-state region, up to temperatures far above the normal boiling point of the metal. The values of R divided by R_{sub}/R and H for the solid and liquid states of these metals are measured at the boiling point and at the temperature corresponding to the beginning of the electrical explosion. $I_{\text{sub}}/I = 1/2$; pulsed heating in water at $T_{\text{sub}}/T = 3/10-15$ microseconds. The values of R divided by R_{sub}/R for Zr, Hf, Nb, Mo remain essentially constant in the liquid-state region up to $T_{\text{sub}}/T = 1/2$. The temperature T_{sub}/T , which is identified as being approximately equal to the critical temperature, is evaluated. In pulsed heating in air there is a dip in the value of R divided R_{sub}/R for the liquid state of all these metals; this behavior is attributed to discharge shunting the sample. 14 Refs.

Primary Keywords: Exploding Wires; Several Wire Materials; Wire Resistance; Wire Enthalpy; Boiling Temperature

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7697
(BREAKDOWN STUDIES)
(Liquid, Electrical)
INVESTIGATION OF THE BREAKDOWN BY RECTANGULAR VOLTAGE PULSES OF A LIQUID IN AN INHOMOGENEOUS FIELD

I.P. Kuznetsov
Moscow Power Institute, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 11, No. 12, pp 1585-1589 (06/1966).

Trans. from: Zhurnal Tekhnicheskoi Fiziki 36, 2125-2130 (December 1967). An investigation is made of the breakdown time of a liquid for water with a conductivity of $2.5 \times 10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1}$ under the action of rectangular voltage waves with amplitudes of up to 100 kV. The characteristics of gaps 1 and 2 cm in length under the action of rectangular voltage waves with amplitudes of up to 100 kV are presented. Descriptions are given of the peculiarities of breakdown of various gaps at various voltages. An empirical formula is given for estimating the mean breakdown time of positive rod-plane gaps of length 1 to 30 cm. 7 Refs.

Primary Keywords: Water Breakdown; Preleader Stage; Streamer Velocity; Rectangular Voltage Pulse; Rod-plane Gap; Formative Time Lag

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7694
(INSULATION, VACUUM)
(
VACUUM INSULATION OF HIGH VOLTAGES UTILIZING DIELECTRIC COATED ELECTRODES

L. Jedynak
University of Wisconsin, Madison, WI
Journal Of Applied Physics, Vol. 35, No. 6, pp 1727-1733 (06/1964).

An experimental research program has demonstrated that the high-voltage performance of a vacuum gap can be improved by the simple expedient of coating the cathode surface with a suitable thin insulating film. Steady voltages ranging to 340 kV were obtained with 5-mm gaps composed of 15-cadmium-Rosniski electrodes simultaneously the working gap was maintained at the 10^{-6} to 10^{-10} A range. Furthermore, it was shown that an insulating film on the anode can be severely detrimental to gap performance. Experiments were performed at voltages up to 380 kV, involving 12 different film materials. Film thickness ranged from 0.2 to 135 micron and film resistivities ranged from 10^{11} to 10^{19} ohm-cm. The dielectric constants were between 1.7 and 3.5, except for one at 92. Based upon the experimental results and their interpretation, a tentative set of specifications can be given for a good cathode film: (1) resistivity of at least 10^{11} ohm-cm; (2) dielectric constant in the range 1.5 to 4; (3) dielectric strength of at least 166 V/cm; (4) film thickness between 10 and 25 micron; (5) mechanically hard and smooth with high abrasion resistance and high adhesion strength (6) no gas bubbles within the film. If bubbles are unavoidable they must be substantially smaller than the film thickness; (7) low vapor pressure; (8) the cathode substrate should be of a highly polished metal suitable for easy deposition of the desired film material. 45 Refs.

Primary Keywords: Vacuum Insulation; Electrode Surface Coating; Current Reduction; Several Film Materials; Variable Film Thickness; Design Criteria

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7706
(PARTICLE BEAMS, ELECTRON)
(Generation)

PULSED FIELD EMISSION CATHODE EMMITTANCE MEASUREMENTS

J.R. Uhlum, S.E. Graybill and S.V. Nablo

Ion Physics Corp., Burlington, MA 01803

The Review Of Scientific Instruments, Vol. 40, No. 11, pp 1413-1414 (01/1969).

A technique is described for the precise determination of the emittance diagram for megaelectron volt beams at energy fluences of up to $100 \text{ J/m}^2 \text{ cm}$. Two megaelectron volt beams from both single point hemispherical stainless steel and planar graphite emitters were studied, and emittance figures of 6×10^{-4} and 10×10^{-4} mrad cm, respectively, were obtained for the central one-quarter portion of the streams generated by each emitter. 16 Refs.

Primary Keywords: Field Emission Diode; Emittance Measurement; MeV Planar Graphite Cathode

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7726
(ELECTROMAGNETIC LAUNCHERS)
(Railguns)

MAGPAC-A RAILGUN SIMULATION PROGRAM

J.J. Deadrick, R.S. Hawke and J.K. Scudder

Lawrence Livermore Laboratory, Livermore, CA 94550

UCRL Report No. UCRL-84877 (10/1980).

Availability: UCRL-84877

NILS

We have developed and validated a computer simulation code at the Lawrence Livermore National Laboratory (LLNL) to predict the performance of a railgun electromagnetic accelerator. The code, called MAGPAC (MAGnetic Railgun ACcelerator), models the performance of a railgun driven by a magnetic flux compression current generator (MFCC). The MAGPAC code employs a time-step solution of the nonlinear time-varying element railgun circuit to determine rail currents. From the rail currents, the projectile acceleration, velocity, and position is found. We have validated the MAGPAC code through a series of railgun tests conducted jointly with the Los Alamos Scientific National Laboratory. This paper describes the formulation of the MAGPAC railgun model and compares the predicted current waveforms with those obtained from full-scale experiments. 8 Refs.

Primary Keywords: Simulation; Numerical Calculation; MAGPAC; Flux Compression Generator; Rail Current; Projectile Acceleration; Velocity; Position

7742
(BREAKDOWN STUDIES)
 (Gas; Optical)
 A PHYSICAL MODEL ON THE INITIATION OF ATMOSPHERIC-PRESSURE GLOW DISCHARGES

A. J. Palmer
 Hughes Research Labs, Malibu, CA 90265
Applied Physics Letters, Vol. 25, No. 3, pp 138-140 (08/1974).
 A model on the preionization requirements for initiating a volume-stabilized glow discharge is proposed. The basic requirement of the model is that the preionized electron density be large enough to cause appreciable spatial overlap of the primary avalanches and consequent smoothing of space-charge field gradients at the stage when streamer formation would otherwise occur. A minimum required preionized electron density of approximately 164 cu.cm. is predicted for a typical CO₂-N₂-O₂ atmospheric glow discharge and is consistent with experimental observations. 11 Refs.

Primary Keywords: Glow Discharge; Volume Stabilization; Preionization; Degree Of Preionization; Theory; Modeling
 Secondary Keywords: Gas Laser Pumping
 CCFYR1 = 1574 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7738
(INSULATION; MATERIAL; BREAKDOWN STUDIES)
 (Solid; Solid; Electrical)
 A TUTORIAL ON TREING

E. J. McMoran
 E.I.T. Co., Wilmington, DE 19898
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 4, pp 7-29 (08/1978).
 Test methods for studying electric breakdown in solid dielectric materials through the mechanism of 'treing' are described. While this tutorial is directed to internally initiated breakdown, the same basic progressive failure occurs in surface initiated breakdown, but at a different rate. Water treing is discussed briefly, not because it is unimportant, but because in most cases water trees can lead to the development of electrical trees which cause the ultimate failure. 10 Refs.

Primary Keywords: Insulation Breakdown; Electrical Treeing; Volume Breakdown; Surface Flashover; Water Tree

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7739
(BREAKDOWN STUDIES)
 (Gas; Electrical)
 ANOMALIES IN IONIZATION COEFFICIENTS AND IN UNIFORM FIELD BREAKDOWN IN ARGON FOR LOW VALUES OF E/P

D.E. Golden and L.H. Fisher
 New York University, University Heights, New York, NY
Physical Review, Vol. 123, No. 4, pp 1079-1086 (08/1961).
 Prebreakdown ionization currents in argon have been measured in uniform fields for low values of the ratio of field strength to pressure, E/p, 5 to 12 V/cm mm Hg. Currents obtained with varying electrode separation d at constant E/p and constant p could not be analyzed to yield values of the Townsend coefficients alpha/p and gamma. Currents obtained with varying p at constant E/p and constant d could be analyzed to yield values of alpha/p and gamma, but such currents yielded coefficients which depend on d. The dependence of the values of alpha/p on d is attributed to the production of highly excited atoms by resonance radiation at some distance from the cathode positions where the electrons lose their energy, these highly excited atoms then produce molecules, ions, and electrons in collisions with ground-state argon atoms. The secondary mechanism and the dependence of gamma on p are associated with resonance radiation. Sparking potential requirements in argon made by varying both p and d for values of p and d corresponding to breakdown for the above range of E/p show deviations from Paschen's law. 29 Refs.

Primary Keywords: Gas Breakdown; Argon Gas; Low E/p; Uniform Field Breakdown; Prebreakdown Current; Variable Gap Spacing; Variable Gas Pressure

COPYRIGHT: 1961 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION

7741
(BREAKDOWN STUDIES)
 (Liquid; Electrical)
 BREAKDOWN AND PREBREAKDOWN PHENOMENA IN LIQUIDS

J.C. Davies, R.W. Ladd and R.J. Schutte
 General Electric Co., Schenectady, NY 12301
Journal Of Applied Physics, Vol. 52, No. 7, pp 4351-4345 (07/1981).
 In this paper we present a comprehensive account of our results on streamer propagation in dielectric liquids in point-plane geometries. Propagation velocities for both positive and negative streamers have been determined as a function of the following parameters: temperature, pressure, density, viscosity, composition, and conductivity. Effects of voltage and interelectrode spacing were examined. Current and light emission during streamer propagation were measured. The relation between shock wave and streamer velocities was investigated. Small concentrations of various additives at potential additives markedly accelerated the positive streamers, while electron scavengers accelerated the negative streamers. Mechanisms to account for these observations are discussed. 36 Refs.

Primary Keywords: Liquid Breakdown; Prebreakdown Current; Point-plane Gap; Optical Diagnostic; Streamer Propagation

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7742
(BREAKDOWN STUDIES)
 (Gas; Electrical)
 BREAKDOWN MECHANISMS IN SULPHUR-HEXAFLUORIDE

N.H. Malik and A.H. Qureshi
 University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 3, pp 135-141 (08/1978).
 The well known breakdown theories, Townsend's generation mechanism and the streamer mechanism, are reviewed and applied to the results of the breakdown in the strongly electronegative gas, sulphur-hexafluoride. Experimental results reported in the literature on the breakdown behavior of sulphur-hexafluoride are examined in the light of these theories. The breakdown characteristics are used for the estimation of the breakdown voltages in pure SF₆. Other factors that may affect the breakdown characteristics of SF₆ have been discussed. Further areas of work have been proposed in order to obtain better understanding of the breakdown mechanism. 76 Refs.

Primary Keywords: SF₆; Breakdown; Breakdown Mechanism; Avalanche Streamer; Breakdown Voltage Prediction

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7743
(BREAKDOWN STUDIES)
 (Gas; Electrical)
 CALCULATION OF DISCHARGE INCEPTION VOLTAGES IN SF/SUB 6/-N/SUB 2/ MIXTURES

N.H. Malik and A.H. Qureshi
 University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 2, pp 70-76 (04/1979).
 A simple method based on the streamer criterion is proposed to calculate the discharge inception voltages in SF₆/N₂/sub 2/ mixtures with SF₆ content between 1 and 100%. It is shown that the calculated values are in good agreement with experimental measurements for gaps having varying degrees of field non-uniformities. 17 Refs.

Primary Keywords: Gas Breakdown; Nitrogen Gas; SF₆/Gas; Theory; Streamer Criterion; Breakdown Voltage Calculation; Nonuniform Field

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7744
(BREAKDOWN STUDIES)
 (Gas; Products)
 CARBON INHIBITION IN SPARKED PERFLUOROCARBON-SF₆/MIXTURES

I. Sauer, T.J. Havens and L.G. Christopher
 Oak Ridge National Lab, Oak Ridge, TN 37830
Journal Of Physics D: Applied Physics, Vol. 13, No. 7, pp 1285-1290 (07/1980).

Decomposition products from sparked 2-C₂/sub 4/F₂/sub 6/ mixtures include the perfluorocarbons, C₂/sub 4/F₂/sub 6/; C₂/sub 4/F₂/sub 6/; C₂/sub 3/F₂/sub 8/; C₂/sub 4/F₂/sub 10/; C₂/sub 5/F₂/sub 12/; and C₂/sub 6/F₂/sub 14/ and two isomers of S₂/sub 2/C₂/sub 2/F₂/sub 6/. Saturated perfluorocarbon products are shown to increase in abundance with increasing concentration of SF₆/sub 6/ in 2-C₂/sub 4/F₂/sub 6/ up to approximately 70% SF₆/sub 6/ in 2-C₂/sub 4/F₂/sub 6/. The most abundant decomposition product perfluoromethane (CF₄) was measured quantitatively for varying concentrations of SF₆/sub 6/ in 2-C₂/sub 4/F₂/sub 6/ and found to show a maximum for the (7%) SF₆/sub 6/-(30%)2-C₂/sub 4/F₂/sub 6/ composition. The data suggest that the suppression of solid carbon deposits is effected by conversion of carbon to gaseous products (mainly saturated perfluorocarbons). Comparison is made with sparked 2-C₂/sub 4/F₂/sub 6/-N₂/sub 2/ mixtures which show no evidence of carbon inhibition. These results indicate that proper tailoring of SF₆/sub 6/-perfluorocarbon mixtures can effectively inhibit carbon formation. 1 Refs.

Primary Keywords: Gas Discharge; Decomposition Products; Perfluorocarbon-SF₆/Mixture; Carbon Deposits; Deposit Inhibition

COPYRIGHT: 1980 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7746
(PARTICLE BEAMS; ELECTRON; PULSE GENERATORS)
 (Generation; Pulse Forming Lines)
 CHARGED, INTERNALLY SWITCHED TRANSMISSION LINE CONFIGURATIONS FOR ELECTRON ACCELERATION

D. Eccleshall, J.K. Temperton and C.E. Hollingsworth
 Army Armament Research and Development Command, Aberdeen Proving Ground, MD 21005
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 3, pp 4245-4247 (06/1979).

High current pulsed electron beams may be accelerated with nominally 100% efficiency using induction accelerators based on strings of charged internally-switched constant-voltage transmission lines. Under certain conditions one string, a regating open circuit voltage waveform which can in principle be used to transfer 100% of stored energy to a beam which is circulated and this would permit a higher overall acceleration gradient. We have also identified some efficient line arrangements which could be exploited in the single pass mode. Some of the fundamental practical limitations to these concepts, such as the pulse distortion at line discontinuities and coupling to the beam, have been addressed. 4 Refs.

Primary Keywords: LINAC; Transmission Line Pulse; Closing Switch; High Transfer Efficiency; Pulse Distortion; Theory

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7747
(INSULATION; MATERIAL; BREAKDOWN STUDIES)

(Ultraviolet; Partial Discharges)
 DEGRADATION PRODUCT ANALYSIS FOR POLYMERIC DIELECTRIC MATERIALS EXPOSED TO PARTIAL DISCHARGES

K.D. Naulty, J.W. Johnson and J. Tanaka
 Institute of Connecticut, Storrs, CT 06268
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 5, pp 527-536 (10/1978).

Partial discharge phenomena appear to play an important role in insulation failure, and thus the analysis of products resulting from such degradation may lead to an understanding of insulation breakdown mechanisms and more accurate determination of insulation lifetimes. Progress in the area of degradation product analysis is reviewed for solid and liquid insulating materials. 10 Refs.

Primary Keywords: Insulation Aging; Insulation Failure; Insulation Lifetime; Calculation

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7750
(INSULATION; MATERIAL)

(Gas)
 DIELECTRIC GAS MIXTURES WITH POLAR COMPONENTS

L.G. Christopher, D.R. James and R.A. Methis
 Oak Ridge National Lab, Oak Ridge, TN 37830
Journal Of Physics D: Applied Physics, Vol. 14, No. 4, pp 675-692 (04/1981).

Dielectric gas mixtures comprising mainly one electron-attracting component and one dipolar component have been investigated. It has been found that polar electron-slowing-down components effect a sharp increase in the breakdown voltage, V_b/sub 2/, with small percentages of electron-attracting additives. The effect of electron-dipole scattering on V_b/sub 2/ for multicomponent gas dielectrics is assessed, especially in combination with indirect electron scattering via negative ion states. The results demonstrate further the beneficial effect of large electron scattering cross-sections at subionization energies on V_b/sub 2/ and suggest that a careful combination of gases slowing down electron-dipole scattering and via negative ion states can effect large V_b/sub 2/ values. This and earlier studies suggest that a number of dielectric gas mixtures containing one or two electron-attracting components from C₂/sub 2/F₂/sub 6/ to CH₂/sub 3/CH₂/sub 2/ or 1,1,1-CH₂/sub 3/CH₂/sub 2/ with N₂/sub 2/ are excellent candidates for larger-scale testing for possible eventual industrial adoption. 32 Refs.

Primary Keywords: Gas Insulation; Gas Mixtures; Polar Gas; Electron-Attracting Gas; Electron Scattering; Several Mixtures

COPYRIGHT: 1981 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7751
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Gas, Electrical)

DISCHARGES

J. H. Mason
Polytechnic Of The South Bank Borough Road, London, UK
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 4, pp 211-230 (08/1978).
The electric strength of solid insulation may decrease greatly with time of voltage application if discharges occur within gaseous inclusions or at the interface between conductors or the solid and the surface from adjacent conductors, or as a result of surface contamination. Mechanisms of breakdown and factors which affect the electric strength of gases are surveyed, as a basis for understanding the complex behavior of internal and surface discharges, particularly temporal changes in their magnitude and recurrence frequency. Mechanisms by which discharges cause progressive degradation and ultimate failure are considered, also techniques for assessing the relative resistance of materials to surface or internal discharges of 'freezing'. Finally the review surveys the merits of different methods for ensuring against failure by discharges. Reliance on short-term over-voltage tests reduces the cost of testing but there is considerable risk of trees or tracking being initiated, depending on the insulation morphology. To fail significantly, discharge measurements reduce this risk, but it is important to discriminate between discharges in the test object and external interference. There is as yet inadequate information for specifying acceptable discharge levels for the many types of insulation and service conditions. 161 Refs.
Primary Keywords: Solid Insulation; Insulation Dielectric Strength; Inclusion; Conductor Edge; Effect Of Voltage Duration; Insulation Testing

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7752
(INSULATION, MATERIAL)

(Effect of DISSOLVED GASES, ORGANIC ADDITIVES AND FIELD CONFIGURATION ON CO-FIELD MOTION IN INSULATING OILS)
A.A. Zaky (1), I.Y. Regahad (2) and M.S. Khalil (2)
(1) College Of Engineering, Riverain, Saudi Arabia
(2) University of Alexandria, Alexandria, Egypt
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 1, pp 21-27 (02/1979).

The effect of dissolved gases ($D_{\text{air}}/2$, air and $H_{\text{air}}/2$) and a wide range of concentration of organic additives (quinoline, toluene and naphthalene) on the electrohydrodynamic head due to co-field motion in transformer oil and liquid paraffin has been measured for both uniform and nonuniform fields using direct voltages. The effect of gap length on the head was also examined. The results indicate that all the dissolved gases investigated as well as toluene and naphthalene reduced the developed head, whereas quinoline increased the head. With a highly nonuniform field the effect of $D_{\text{air}}/2$ and toluene was found to be strongly dependent on the polarity of the point electrode. 10 Refs.

Primary Keywords: Liquid Insulation; Transformer Oil; Dissolved Gas; Oxygen; Air; Nitrogen; Organic Additive; Quinoline; Toluene; Naphthalene; Co-field Induced Motion

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7753
(INSULATION, MATERIAL)

(Solid);
ELECTRIC FIELDS AND SECONDARY EMISSION NEAR A DIELECTRIC-METAL INTERFACE
J.W. Robinson and N. Quoc-Nguyen
Pennsylvania State University, University Park, PA
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 1, pp 14-20 (02/1979).

Dielectric surface charge distributions near a metal dielectric interface in vacuum depend upon secondary emission processes in the presence of normal and tangential components of electric fields. From measured charge distributions created by exposing surfaces of fluorinated ethylbenzene-propylene to nonionizing electron fluxes, it has been possible to deduce potentials and fields on and near the dielectric surface. The effect of normal electric field upon secondary emission is measured directly and the effect of the tangential field is inferred from the charge distribution data. The critical point (unity crossover) for secondary emission is shifted by the application of fields so that it occurs at much higher primary energies than normally. Primary beams having energies up to 20 keV are used and surface fields are as high as 20 kV/mm. 14 Refs.

Primary Keywords: Solid Insulation; Surface Charging; Dielectric-electrode Interaction; Secondary Emission; Vacuum Environment

COPYRIGHT: 1979 IEEE. REPRINTED WITH PERMISSION

7756
(BREAKDOWN STUDIES)

(Gas, Peccover)
ELECTRON ATTACHMENT TO SF₆/SUB 6/
F.C. Fehsenfeld
Aeronautics Lab., ESSA Research Labs, Boulder, CO 80302
The Journal Of Chemical Physics, Vol. 53, No. 5, pp 2000-2004 (09/1970).
The attachment rate for electrons to SF₆/SUB 6/ has been measured between 291 K and 1.5 Deg K, in a helium-buffered flowing afterglow over the pressure range of 0.1-1.5 Torr. The attachment has a rate constant of $2 \times 10^{-11} \text{ cm}^3/\text{sec}$, independent of temperature and pressure. The primary reaction product over the measured range of temperatures is SF₆/SUB 6/S⁻. However, the rate of production of SF₆/SUB 6/S⁻ increases rapidly with temperature. 17 Refs.

Primary Keywords: Solid Insulation; Attachment Rate Measurement; 293-523 Deg K; Temperature Range; 0.1-1.5 Torr Pressure Range; Constant Rate

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7757
(BREAKDOWN STUDIES)
(Gas, Electrical)

ELECTRON-OPTICS STUDY OF THE DEVELOPMENT OF AN ELECTRIC DISCHARGE IN A GAS AT HIGH-ELECTRIC FIELD INTENSITIES AND WITH ONE-ELECTRON IGNITION
L.G. Bychkova, Yu.I. Bychkov, G.A. Mesyats and Ye.Ya. Yurik
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics Journal, Vol. 12, No. 11, pp 1389-1391 (11/1969).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii Fizika 12, 24-27 (November 1969).

A study was made of the luminous region in a discharge gap with carbon electrodes, a field of $E = 80 \text{ kV/cm}$, air at atmospheric pressure, and a gap width of 4 or 2 mm. The cathode was irradiated with a spark to ionize the initial electrons. The electron current from the cathode was 0.259 electrons/sec. The exposure time per frame was 3.6 sec. With a gap width of $\Delta = 4 \text{ mm}$, a luminous region is observed at the cathode 2 nsec after voltage is applied to the gap; this region propagates toward the anode, simultaneously increasing in diameter, at a velocity of approximately 10^3 cm/sec . A voltage drop is established across the gap approximately 0.5 nsec after the luminous front arrives at the cathode. In narrower gaps, the voltage drop is established across the gap a considerable time after the luminous region has crossed the gap. 19 Refs.

Primary Keywords: Spark Discharge; Copper Electrodes; Air-Gas; Atmospheric Pressure; Channel Luminosity; Photographic Diagnostic; Voltage Measurement; Correlation

COPYRIGHT: 1977 PLenum Press. REPRINTED WITH PERMISSION

7759
(ARTICLE BEAMS, ION; PARTICLE BEAMS, ION)

(Generation; Transport)
EXTRACTION AND FOCUSING OF INTENSE ION BEAMS FROM A MAGNETICALLY INSULATED DIODE
S. Humphries Jr., R.M. Sudan and L. Wiley
Cornell University, Ithaca, NY 14850
Journal Of Applied Physics, Vol. 47, No. 6, pp 2382-2390 (06/1976).

A magnetically insulated diode has been used to produce cylindrically converging intense proton beams. By providing electron neutrals along field lines, the beams can be propagated across the magnetic field to within 1 cm of the axis. Proton currents up to 5 kA have been generated to achieve current densities up to 70 A/cm^2 . Divergences less than 3° have been achieved with new plasma anodes despite calculations are presented on the extrapolation of magnetic diodes to achieve power densities needed for ion-beam pellet-fusion break-even. 19 Refs.

Primary Keywords: Ion-beam Generation; Field Emission Diode; Plasma Anode; Solid Cathode; Magnetic Insulation; Self-focusing Beam

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7761
(BREAKDOWN STUDIES)

(Gas, Electrical)

GROWTH OF THE SPARK DISCHARGE CANAL FOR A DISCHARGE CIRCUIT WITH A RAPIDLY INCREASING CURRENT

I.T. Andreev, M.P. Vanykov and A.B. Kotylev
Soviet Physical-Technical Physics, Vol. 17, No. 1, pp 37-40 (07/1962).
Trans. From: Zhurnal Tekhnicheskoy Kibernetiki, Vol. 17, No. 1, pp 57-62 (January 1962).

Using an apparatus with a 10^{-3} sec (nanosecond) solution time we studied the development of a spark discharge canal in air for the case of a discharge circuit with a rapidly increasing current. We compared our results with the results calculated by means of Drabkin's and Braginskii's theories. We registered, experimentally, canal widening rates of $10-12 \text{ km/sec}$. 11 Refs.

Primary Keywords: Gas Discharge; Spark Channel; 10^{-3} A/sec Current Rise Rate; Canal Growth; Experiment; Theory

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7762
(BREAKDOWN STUDIES)

(Gas, Electrical)

HIGH CURRENT SPARK CHANNELS

J.E. Allen and J.D. Draper
University of Liverpool, Liverpool, UK
British Journal Of Applied Physics, Vol. 5, pp 446-453 (12/1954).

Measurements have been made on high current (up to 265 kA) spark channels in air, argon and hydrogen. The voltage gradients existing in the channels were determined by oscillographic measurements and were found to increase with increasing current in the range studied. Power inputs of 10^6 to 10^7 mewatts per centimetre length of channel were determined and the measured voltage gradients. Rotating-mirror photographs of the discharges were taken, using a camera with a shutter faster than $1/5$ of a micron. The photographs obtained show a number of interesting features which are peculiar to these high current discharges, the most of one being the bright central core of the channel which is visible in the photographs. Temperatures of about 10^5 Deg K were estimated from electron mobility considerations. The central core of the discharge appears to be due to the self-magnetic 'pinch' effect, and calculations based on this inference suggest that high ion densities (approximately 10^{19} per cm^3) exist in the centre of the core; the energy requirements for such conditions are compatible with the measured power inputs. 29 Refs.

Primary Keywords: Spark Channel; Air Breakdown; Argon Breakdown; Hydrogen Breakdown; Voltage Measurement; Current Measurement; Temperature Measurement; 265 kA Current

COPYRIGHT: 1954 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7765
(SWITCHES, CLOSING)

Vacuum Gaps, Electrical)

HIGH-POWER VACUUM SPARK GAP

J.C. Hageman and A.H. Williams
Los Alamos National Lab, Los Alamos, NM 87545
The Review Of Scientific Instruments, Vol. 30, No. 3, pp 182-183 (03/1959).

The design and construction of a voltage graded vacuum spark gap is described. The gap is capable of switching currents as large as 166 amp at voltages up to 75 KV. The effect of the insulating walls of the gap is briefly discussed. 2 Refs.

Primary Keywords: Vacuum Spur Gap; Voltage Grading; Insulation Effects; 75 KV Operating Voltage; 1 MA Switch Current

COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7766
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas; Electrical; Electrodes)

HIGH-TEMPERATURE EFFECTS ON FLASHOVER IN AIR

L.E. Alston
A Rayville & Co. Ltd., Hebburn, County Durham, UK
Proceedings of The IEE, Vol. 105, Part A, No. 24, pp 549-553 (12/1958).
The authors report a study of electrode temperature effects on gas breakdown experiments were conducted with hot spots to 1200 Deg.C. These hot spots were found to lower the breakdown voltage considerably in uniform-field gaps but had lesser effect in the low-field regions of non-uniform gaps. This effect is used to explain the triggering mechanism of triatron gaps. 6 Refs.
Primary Keywords: Gas Breakdown; Electrode Effects; Electrode Hot Spot; Gas Heating; Breakdown Voltage Reduction; Triatron Operation; Circuit Breaker Operation

COPYRIGHT: 1958 IEE

7767
(SWITCHES; CLOSING)
(Gas Gaps; Electrical)

HIGH-VOLTAGE, LOW-INDUCTANCE SWITCH FOR MEGAMPERE PULSE CURRENTS

W.R. Baker
Lawrence Berkeley Lab, Berkeley CA
The Review of Scientific Instruments, Vol. 30, No. 8, pp 700-702 (08/1959).
A switch is described that will handle pulse currents of several millions of amperes and stand off DC supply voltages of over thirty kilovolts. It is useful in powering fast pinch devices such as those used in thermonuclear research. 3 Refs.
Primary Keywords: Low Pressure Gas Switch; Low Inductance; High Reliability; Long Switch Life; Plasma Baffle; Fast Dilectric

COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7769
(INSULATION; MATERIAL; BREAKDOWN STUDIES)

(Solid; Surface Flashover); LICHENBERG FIGURES ON VARICOUS ELECTRICAL INSULATING MATERIALS

A. Kawashima and S. Hoh
College of Technology, Seikei University, Tokyo, Japan
IEEE Transactions On Electrical Insulation, Vol. EI-13, No. 1, pp 51-56 (02/1978).

The surface discharge on insulating solid materials was recorded by a camera with high speed films. This simple method was found to be useful for the investigation of the surface discharge on various insulating materials. Lichtenberg figures on the surface of seven types of insulating material were determined by this method. The starting voltage for the formation of Lichtenberg figures was found to depend on the surface resistance of the insulating material, while the rate of development of surface discharge with the applied voltage depends on the relative permittivity of the insulating materials. It is reported that the electric strength of an insulating material can be improved by covering its surface with highly resistive materials. 5 Refs.
Primary Keywords: Lichtenberg Figure; Surface Flashover; Photographic Diagnostic; Flashover Voltage; Surface Resistance; Insulator Permittivity

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7771
(PARTICLE BEAMS; ION; INSULATION; MAGNETIC)
(Generation)

MICROSECOND-PULSE INSULATION AND INTENSE ION BEAM GENERATION IN A MAGNETICALLY INSULATED VACUUM DIODE

S.C. Luckhardt and H.H. Fleischmann
Cornell University, Ithaca, NY 14850
Applied Physics Letters, Vol. 30, No. 4, pp 182-185 (02/1977).
The insulation and ion generation characteristics of coaxial magnetically insulated diodes were tested using microsecond voltage pulses from a Marx generator with magnetic fields ranging up to 20 kOe, voltages of 150-300 kV, and gap widths of 0.3-0.9 cm. Voltage standoff was observed for up to 4 microseconds when using graphite or molybdenum electrodes. With plasma-producing tungsten filament anodes high-current ion beam pulse lengths of up to 1.5 microseconds and total charge generation densities of up to 1.5 microamperes/sq.cm. were obtained. 16 Refs.

Primary Keywords: Vacuum Diode; Ion Beam Generations; Microsecond Pulse Length; Marx Generator; Graphite Electrodes; Tungsten Electrodes

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7773
(BREAKDOWN STUDIES)

(Gas; Electronic)
ON THE ROLE OF THE ELECTRON IMPACT IONISATION AND ELECTRON SCATTERING CROSS-SECTION IN THE BREAKDOWN STRENGTH OF DIELECTRIC GASES

L.G. Christodoulou, D.R. Jones and R.A. Mathis
Oak Ridge National Lab, Oak Ridge, TN 37816
Journal of Physics D: Applied Physics, Vol. 12, No. 8, pp 1223-1236 (08/1979).

In this paper we discuss the role of the electron impact ionisation cross-section (σ_{ion})/sub 1/(epsilon) and the electron scattering cross-section (σ_{scat})/sub 1/(epsilon) as a function of electric energy erosion in the breakdown strength of gas mixtures. Four gases (He, Ar, N/sub 2//sub 2/ and Si/sub 2//sub 6/) were chosen for which σ_{ion} /sub 1/(epsilon) and σ_{scat} /sub 1/(epsilon) at ion energies are known. Direct-current breakdown strengths measurements on He, Ar, N/sub 2//sub 2/ and Si/sub 2//sub 6/ (Ar SF/sub 6//sub 2/), (Ar N/sub 2//sub 2//sub 2/), (N/sub 2//sub 2//sub 2/ + He 1 SF/sub 6//sub 2/), and (N/sub 2//sub 2//sub 2/ + Ar 1 SF/sub 6//sub 2//sub 2/) were made and are reported using spherical anodes to reduce end effects due to the finite electrode geometry. On the basis of these measurements and the relation σ_{ion} /sub 1/(epsilon)/sub 1/(epsilon) and σ_{scat} /sub 1/(epsilon)/sub 1/(epsilon) it was concluded that the magnitude of σ_{ion} /sub 1/(epsilon)/sub 1/(epsilon) at subionisation (epsilon < 1) and especially at subexcitation (epsilon < 1) energy of incident excited electronic states energies is much more significant in affecting a high dielectric strength than is σ_{scat} /sub 1/(epsilon)/sub 1/(epsilon). The effect of polarization and static polarizability on σ_{ion} /sub 1/(epsilon)/sub 1/(epsilon) is also discussed. 28 Refs.

Primary Keywords: Gas Breakdown; Electron Impact; Electron Scattering; Ionization Cross Sections; Sphere-Sphere Gap; Sphere-Plane Gap; Rod-Plane Gap; Neur Gas; Argon Gas; Helium Gas; SF/sub 6//sub 2/Gas

COPYRIGHT: 1979 IEE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7775
(PARTICLE BEAMS; ION; INSULATION; MAGNETIC)

PREDICTION OF INTENSE PROTON FLUXES IN A MAGNETICALLY INSULATED DIODE

P. Dreike, C. Eichenberger, S. Humphries and R. Sudan
Cornell University, Ithaca, NY 14850
Journal of Applied Physics, Vol. 47, No. 1, pp 85-87 (01/1976).
A magnetically insulated diode has been used to produce intense fluxes of protons with high efficiency. Currents in excess of 4 kA with current density greater than 50 A/sq.cm. have been produced in a 15 ns bursts at energies up to 200 keV. The system appears to be easily scalable to higher parameters. The extraction of the beams, as well as geometries in which current densities of kA/sq.cm. may be realized, are discussed. 8 Refs.

Primary Keywords: Ion Beam Generation; Magnetically Insulated Diode; Length; 200 keV Beam Energy; 4 kA Beam Current; 50 ns Pulse Length

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7776
(BREAKDOWN STUDIES; INSULATION; MATERIAL)

(Liquid; Electrical; Liquid)

PROGRESS IN THE FIELD OF ELECTRIC BREAKDOWN IN DIELECTRIC LIQUIDS

A.M. Sankaran, C. Devins and S.J. Pineda
General Electric Co., Schenectady, NY 12301
IEEE Transaction on Electrical Insulation, Vol. EI-13, No. 4, pp 249-271 (07/1978).

For some forty years the mechanism of electric breakdown in liquid insulation has been a subject of great interest for both theoretical as well as practical reasons. Over the years a number of promising hypotheses of breakdown have been advanced and it has been necessary to modify, and sometimes reject, interpretations of the breakdown data as additional experimental evidence has been accumulated. In this report, we shall first examine some of the difficulties which are encountered in the measurement and interpretation of breakdown phenomena in the liquid state. Comparisons and generalizations with breakdown in gases and solids will be made, wherever possible. The concept of the 'intrinsic strength' of a liquid will be discussed, as well as the development of the very important experimental techniques which have been used in insulation and breakdown studies. 122 Refs.

Primary Keywords: Liquid; Liquid Breakdown; Diagnostics; Comparison With Gas Breakdown; Intrinsic Strength; Thermal Runaway

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7779
(SWITCHES; CLOSING)

(Vacuum Gaps; Electrical)

SOIL PROPERTIES OF A GRADED VACUUM SPARK GAP

J.W. Matthes and A.H. Williams
Los Alamos National Labs, Los Alamos, NM 87545

The Review of Scientific Instruments, Vol. 31, No. 3, pp 297-303 (03/1960).

A high power, low inductance vacuum spark gap combination (crowbar and main switch) is described which is capable of DC operations over a wide voltage range. The electrical properties are discussed in regard to shorting and multiple switch operation. The principal difficulty of vacuum spark gaps, the coating of the inner surface of the insulator with evaporated and sputtered electrode material, is absent in this design after conditioning. A mechanism to account for this, based on the establishment of a large number of nucleation centers on the insulating walls, is shown to be consistent with observation. 15 Refs.

Primary Keywords: Vacuum Spark Gap; Crowbar Switch; Starting Switch; High Power; Low Inductance; Insulation Conditioning; Metal Vapor Absorption

COPYRIGHT: 1960 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7780
(INSULATION; MATERIAL)

(Composite)

SOLID PROPERTIES OF SOLID-LIQUID COMPOSITE DIELECTRIC SYSTEMS

Parikh
Central Research Association, Leatherhead, Surrey, UK
Transactions on Electrical Insulation, Vol. EI-13, No. 4, pp 289-317 (07/1978).

The rheological and electrical aspects of the electrical properties of solid-liquid dielectrics are discussed with special relevance to the utilization of such systems at high electric stresses. The mechanical and electrical interactions, dielectric loss and breakdown in the solid-liquid system have been related to the performance of the solid-liquid system as a whole. The effects of solid dielectric thickness and breakdown processes for the impregnated dielectric in different situations. The use of plastic films, with or without paper, in impregnated capacitors is treated at some length as a useful device for developing the criteria which are important in all highly stressed solid-liquid systems. Considerable attention is given to aging phenomena and the way in which they may lead to various forms of failure in impregnated systems. Comprehensive data are provided from a summary of the literature relating to effects of temperature and electric stress applied singly and in combination. The effects of life-enroling additives have been discussed briefly. 64 Refs.

Primary Keywords: Solid-Liquid Composite Insulation; High Insulation Stress; Losses; Insulation Breakdown; Plastic Film Insulation

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

7783
(BREAKDOWN STUDIES)
(Gas; Electrical)

STATIC FIELD BREAKDOWN OF SF₆/N₂/SUB 2/ MIXTURES IN ROD-PLANE GAPS
H. Malik, A. H. Gureishi and G. D. Theophilus
University of Windsor, Windsor, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 2, pp 61-69
(04/1979)

The static field breakdown and corona characteristics of SF₆/N₂/SUB 2 mixtures in rod-plane gaps for applied voltages of positive and negative polarities are discussed. Mixtures containing up to 10% SF₆/SUB 2/ are studied over a pressure range of 100 to 500 kPa. The results show that for such gaps, the dielectric behavior of SF₆/N₂/SUB 2/ mixtures is very similar to that of pure SF₆/SUB 2/. A discontinuity is reported in the breakdown voltage-pressure characteristics of SF₆/SUB 2/ and SF₆/N₂/SUB 2/ mixtures when the rod electrode is positive. The pressure at which this discontinuity is observed is higher for the mixtures than for pure SF₆/SUB 2/ and is affected by the mixture ratio. The breakdown voltage for certain mixtures is up to 70% higher than that of pure SF₆/SUB 2/. When the rod electrode is negative, breakdown strength of N₂/SUB 2/ is very sensitive to the presence of small amounts of SF₆/SUB 2/ and is almost doubled if 10% of SF₆/SUB 2/ is added to N₂/SUB 2/. The breakdown and corona characteristics are discussed in detail. 23 Refs.

Primary Keywords: Gas Breakdown; Nitrogen Gas; SF₆/SUB 2/ Gas; Gas Mixtures; Rod-plane Gap; Both Polarities; Breakdown Discontinuity; 100-500 kPa Pressure Range

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

7785
(BREAKDOWN STUDIES)
(Gas; Electrical)

THE CHANNEL OF THE SPARK DISCHARGE

J. W. Flowers
General Electric Co., Pittsfield, MA 01201

Physical Review, Vol. 64, Nos. 7 and 8, pp 225-235 (10/1943).
The luminous channel of the spark discharge and the discharge current are simultaneous measurements made during the spark discharge in air. Concepts to establish a channel in which the current density is a constant value of the order of 1E3 amperes/cm². During the formation of the channel, which takes place by an expansion process producing a pressure or sound wave, the current density is much greater. Throughout most of the formation time and the subsequent history of the channel, the light energy which is radiated is proportional mainly to the current within the channel. From potential measurements and the photographic records, the energy requirements for development are considered, and some possible relations of these requirements to the electrical circuits are discussed. The data are also discussed in relation to the progression of streamers. The pilot streamer theory of the lightning discharge is indicated to be unsatisfactory by comparison with measured discharge characteristics and the associated roles assumed for diffusion and recombination processes in the spark discharge channel do not appear valid. 23 Refs.

Primary Keywords: Spark Discharge; Radiation Measurement; Current Measurement; Air Breakdown; Pressure Wave; Streamer

COPYRIGHT: 1943 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

7788
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Electrodes; Vacuum, Electrical)

THE INFLUENCE OF SOLID-STATE COHESION OF CONDITIONED METAL ELECTRODES ON THE ELECTRICAL STRENGTH OF THE VACUUM GAP

A. K. Vish
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-11, No. 4, pp 160-162 (12/1976).

The solid-state cohesion of metals maintaining electrical stress across a vacuum gap appears to determine the magnitude of the electric strength of the vacuum gap. For conditioned electrodes (presumably free of adsorbed surface layers) under direct-voltage conditions, higher electric strengths are associated with metals having high metal-metal bond energies and vice versa. 7 Refs.

Primary Keywords: Vacuum Breakdown; Electrode Effects; Solid State Cohesion; Microparticle; Electrode Conditioning

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

7789
(SWITCHES, OPENING)
(Mechanical)

THE NATURE OF METAL-ELECTRODES/SF₆/SUB 2/ REACTIONS IN SF₆/SUB 2/ DECOMPOSITION DUE TO DC-CURRENT INTERRUPTION UNDER SIMULATED CIRCUIT-BREAKER CONDITIONS

A. K. Vish
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-11, No. 4, pp 157-162 (12/1976).

The nature of metal/SF₆/SUB 2/ reactions under direct-current (DC) simulated circuit-breaker conditions has been examined in order to explore: 1) the identity of the process(es) responsible for the different magnitudes of electrode consumption for various pure metals; 2) the factors determining the different rates of reaction with SF₆/SUB 2/ observed for different metals. It is concluded that high-current arc fractions, which would be expected to consume the metal in the absence of SF₆/SUB 2/, is also the primary cause of weight loss of electrodes in the presence of SF₆/SUB 2/. The rates of reaction of the deposited metal seem to be related to their tendencies to attack SF₆/SUB 2/ at the sulphur 'sites' and not, as is generally assumed, at the fluorine 'sites.' Rather good correlations are observed between the reaction rates and the heats of formation per equivalent for metal sulphides or the electrode potentials for metal/metal sulphide electrodes. 5 Refs.

Primary Keywords: DC Circuit Breaker; Gas electrode Reaction; SF₆/SUB 2/ Gas; Erosion;

COPYRIGHT: 1976 IEEE, REPRINTED WITH PERMISSION

7791
(BREAKDOWN STUDIES)
(Gas; Electrical)

THEORY OF THE DEVELOPMENT OF A SPARK CHANNEL

S. I. Uraginskii
Soviet Physics JETP, Volume 7, No. 6, pp 1068-1072 (12/1958).
Trans. from: Zashchita elektr.-metall. no 1 Teoreticheskai Fizika 34,
1558-1555 (June 1958)

The principle processes taking place in a spark channel at moderate currents are examined. Solutions are obtained for the motion of the gas outside the channel. A new type of hydrodynamic jump is considered—a strong discontinuity with external supply of heat. Certain solutions are found which describe the state of the gas inside the channel, and expressions are obtained for the characteristic parameters of the channel (radius, temperature, etc.). 12 Refs.

Primary Keywords: Spark Channel; Hydrodynamic Model; Moderate Current; Shock Wave; Channel Interior; Channel Exterior; Theory

COPYRIGHT: 1958 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7792
(BREAKDOWN STUDIES)
(Surface Flashover)

THEORY OF THE SECONDARY ELECTRON AVALANCHE AT ELECTRICALLY STRESSED INSULATOR-VACUUM INTERFACES

K. D. Bergeron

Sandia Lab., Albuquerque, NM 87115

Journal Of Applied Physics, Vol. 48, No. 7, pp 3073-3080 (07/1977).
Several aspects of the secondary emission avalanche along an insulator surface (which is believed to play a role in insulator flashover) are addressed theoretically. The saturation condition for the two extremes of supply-limited and space-charge-limited current are obtained in analytic form, and comparison with the computer simulation of Anderson is made. Also, the effect of a strong magnetic field parallel to the insulator surface and perpendicular to the electric field is analyzed, taking into account the distribution of emission angles. It is found that the critical magnetic field for inhibition of flashover is reduced by a factor of about 2 when the distribution of angles is included in the calculation. 14 Refs.

Primary Keywords: Surface Flashover; Vacuum Environment; Polyethylene Dielectric; Glass Dielectric; Secondary Emission; Supply-limited Current; Space-charge-limited Current

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7793
(DIAGNOSTICS AND INSTRUMENTATION)
(Vt; teov)

CALIBRATION OF UNIFORM-FIELD SPARK-GAPS FOR HIGH-VOLTAGE MEASUREMENT AT POWER FREQUENCIES

F. M. Bruce
English Electric Valve Co Ltd, Chelmsford, Essex, UK

Proceedings Of The IEE, Vol. 93, Pt. 3B, pp 138-156 (04/1947).

Spark gaps have been used to measure high voltage. The best design allows breakdown through a fine field to provide good repetitive behaviour. An equation describes such a spark and derive an empirical relationship for the gap breakdown in the range 9-315 KV. An accuracy of 2% is claimed for the formula. 11 Refs.

Primary Keywords: Voltage Measurement; Spark Gap Diagnostic; Gap Calibration; Empirical Formulae; Gap Preparation

COPYRIGHT: 1947 IEE

7800
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Lightning; Gas; Electrical)

COMPARISON OF LIGHTNING AND A LONG LABORATORY SPARK

M. A. Lunn
Westinghouse Research and Development Center, Pittsburgh PA

Proceedings Of The IEEE, Vol. 59, No. 6, pp 457-460 (04/1971).

Long laboratory sparks are often considered to be miniature lightning. The salient properties of 4-m sparks created by impulse breakdown between a negative rod and a grounded plane by the Westinghouse Traford 6.4 MV impulse generator are compared with those properties of natural lightning. In particular, a comparison is made of the luminous processes associated with breakdown, the current, voltage, power, and energy inputs to the discharges, the radiated visible spectra, the temperature, electron density, and pressure in the discharge channels, the absolute broad-band radiation in the visible and near infrared wavelength range, and the radiated acoustic signals. The spark return stroke most resembles with subsequent stroke in a multiple stroke lightning flash. The leader processes of the spark differ considerably from those of lightning. 17 Refs.

Primary Keywords: Lightning; Air Breakdown; Rod-plane Gap; Voltage Measurement; Current Measurement; Luminosity Measurement

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

7801
(PARTICLE BEAMS; ELECTRONS)
(Generation)

DEVELOPMENT OF AN ADVANCED PULSED ELECTRON BEAM ACCELERATOR

P. Champey, G. I. Hatch, K. Nielsen, S. Shore and J. Smith
Physic International Co., San Leandro, CA 94577

Final Report, Jan. 1972, HG-PIFR-126, 105-p (10/72).

Availability: NTIS

The report covers the development of a 50-kJ generator capable of producing currents in excess of one megampere at voltages approaching the megavolt with a pulse width about 55 nsec. The concept is to feed an electron accelerating tube from two modules, each containing multiple Mylar synchrolines arranged in a series-parallel configuration. Each module contains 8 Blumleins with a total output of 0.5 kA at 1 MV. The modular concept permits the individual Mylar lines to be assembled in air and vacuum-impregnated with carbon sulphur solution. The module and strip lines are easily attached to the accelerating tube. Additional modules can be added to the present design to increase the machine power output. (Author). Primary Keywords: Electron Accelerators; Design; Electron Beams; Pulse Generators; Electrodes; Strip Transmission Lines; Dielectrics; Electric Switches

Secondary Keywords: Marx Generators

AD-A131 753

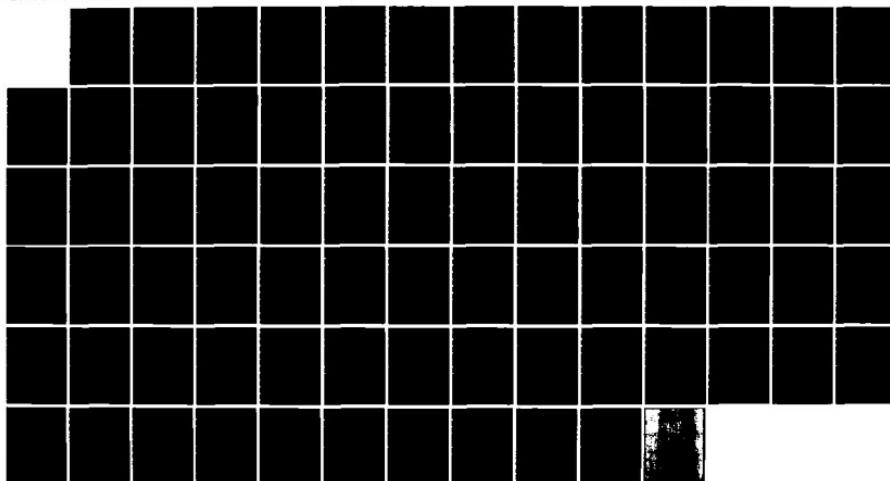
PULSED POWER BIBLIOGRAPHY VOLUME 2 ANNOTATED
BIBLIOGRAPHY(U) AIR FORCE WEAPONS LAB KIRTLAND AFB NM
J BEMESDERFER ET AL. AUG 83 AFWL-TR-83-74-VOL-2

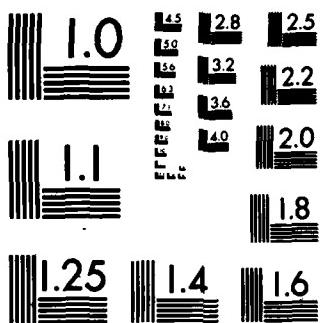
3/3

UNCLASSIFIED

F/G 20/5

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

**7802
(BREAKDOWN STUDIES)**

(Gas; Electrical)
EFFECTS OF FORCED CONVECTION UPON THE CHARACTERISTICS OF A STEADY-STATE CROSS-FLOW ARC IN THE PRESENCE OF AN APPLIED TRANSVERSE MAGNETIC FIELD
A.L. Baker and D.M. Benenson
State University of New York at Buffalo, Buffalo, NY 14226
Proceedings Of The IEEE, Vol. 59, No. 4, pp 450-456 (04/1971).

Experiments were conducted upon a 130-A 1.1- μ sec balanced argon arc over a range of velocities from 5.00 to 13.13 m/sec; electrode spacing was 12.7 mm. Two stable modes of operation were found: the collinear mode, with arc attachments fix at the midpoints of the electrodes, and the upstream mode, with arc attachments at the upstream sides of the electrodes. Below a critical velocity of about 5 m/sec, the collinear mode only was found. For the collinear mode, current distributions, cross-sectional shape, and profile varied markedly with distance along its length; those were observed to be relatively uniform for the upstream mode. Significant lateral broadening of both configurations was found. The effect of velocity upon the upstream mode was to decrease the relative broadening of the plasma. 7 Refs.

Primary Keywords: Steady Arc; Cross-flow Arc; Transverse Magnetic Field; Two Operating Modes; Critical Velocity; Arc Broadening

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

**7803
(SWITCHES, CLOSING)**

(Gas; Paper; Optical)

EFFECTS OF TARGET-ELECTRODE POLARITY AND FOCAL-PLANE POSITION ON A LASER-TRIGGERED GAP

V.A. Radichkin and G.Ya. Rusekova
D.V. Efremov Institute, Leningrad, USSR

Soviet Physics-Techical Physics, Vol. 18, No. 2, pp 223-224 (08/1973). Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 345-348 (February 1973). Delay measurements are given for breakdown in an 11.7 mm air gap triggered by a ruby laser with a power of 20 MW. The triggering time is measured as a function of applied voltage for various positions of the focal plane of the lens and target polarities. In the voltage range (0.6-1.0)U_{sub 0}/sub 0.5 is the gap breakdown voltage, the delay is reduced as the focal plane recedes from the surface of the target; the delay is increased when the target electrode acts as the anode. If U < 0.6 U_{sub 0}/sub 0.5 minimum delays are observed when the radiation is focused on the cathode in the gap. The results are interpreted in terms of shadow studies of channel formation. 4 Refs.

Primary Keywords: Polarity Effects; Ruby Laser; Air Gap; Delay Measurement; Delay Variation With Focal Point

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7804

(INSULATION, MATERIAL; DIAGNOSTICS AND INSTRUMENTATION)

(Solid; E-field)

ELECTRIC STRESSES AT CONDUCTING SURFACES LOCATED IN THE FIELD BETWEEN PLANE PARALLEL ELECTRODES

B. Salvage
Queen Mary College, London, UK

Proceedings Of The IEE, Vol. 111, No. 6, pp 1173-1174 (06/1964).

Following the reasoning of a previous paper, the authors calculate the E-fields at the boundaries of conducting bodies placed between parallel-plane electrodes. Elliptical cylinders and oblate spheroids are considered with their major axes parallel to the field. Several specific calculations are performed with results presented. 4 Refs.

Primary Keywords: E-field Calculation; Elliptical Cylinder; Oblate Spheroid; Parallel-plane Electrodes; Laplace's Equation

COPYRIGHT: 1964 IEE

7805

(INSULATION, MATERIAL; BREAKDOWN STUDIES)

(Solid; Gas; Electrical)

ELECTRIC STRESSES IN GASEOUS CAVITIES IN SOLID DIELECTRICS

B. Salvage
Leeds University, Leeds, UK

Proceedings Of The IEE, Vol. 111, No. 6, pp 1162-1172 (06/1964).

The E-fields in elliptic cylindrical and oblate spheroid cavities in a solid insulator are the subjects of this paper. The E-fields are calculated for the general case of these cavities for several cases of parallel-plane electrodes. Several specific cases are considered with data presented. 18 Refs.

Primary Keywords: Solid Insulation; Gaseous Cavity; Elliptic Cylindrical Cavity; Oblate Spheroid Cavity; E-field Calculation; Parallel-plane Electrodes

COPYRIGHT: 1964 IEE

7807

(ELECTROMAGNETIC LAUNCHERS)

(Relays)

ELECTROMAGNETIC ACCELERATION OF MACROPARTICLES TO HIGH VELOCITIES

S.C. Rashleigh and R.A. Marshall

Australian National University, Canberra, Australia

Journal Of Applied Physics, Vol. 49, No. 4, pp 2540-2542 (04/1978). An inductively driven rail-gun macroparticle accelerator has been built in which velocities of 5.9 km/sec have been obtained using an arc as the driving armature. Simple theory is shown to be adequate for predicting rail-gun performance up to that velocity and for designing rail guns for launching large masses. 7 Refs.

Primary Keywords: Gun; Inductive Energy Store; Arc Driver;

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7808

(BREAKDOWN STUDIES)

(Gas; Electrical)

FORM FACTOR METHOD YIELDS THERMAL CONDUCTIVITY AND RADIATED POWER OF NITROGEN ARC

H.M. Pfleider (1) and D.T.J. Ter Horst (2)

(1) Alfa-Chalmers, Boston Plant, Boston, MA

(2) Eindhoven University of Technology, Eindhoven, Netherlands

Proceedings Of The IEEE, Vol. 59, No. 4, pp 601-604 (04/1971).

The form factor method for the determination of thermal conductivity is applied to experimental results obtained with a cascade arc in nitrogen. Experimental and theoretical thermal conductivities agree, even at temperatures above 10000 Deg K. If rather high radiation losses are taken into account, this result does not change significantly when reabsorption is considered by means of an absorption form factor and the total absorbed power. 11 Refs.

Primary Keywords: Nitrogen Arc; Cascade Arc; Thermal Conductivity;

Radiated Power; Experiment; Theory; Form Factor Method

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

7809

HIGH VOLTAGE PULSER TECHNIQUES FOR ELECTROMAGNETIC PULSE (EMP) SIMULATORS

J.S. Granados, J.T. Haff, W.F.J. Crewson and C.H.J. Jones
AFWL, Kirtland AFB, NM 87117
Final rept. Sep 72-Jun 74 (07/1975).

Availability: AD-A013 783/6ST
NTIS

This report presents the results of both theoretical and practical investigations aimed at improving the performance of a number of key components that are common to many EMP high voltage generators. The advantages of component redundancy over attempting to achieve extreme individual component reliability are outlined. Common capacitor faults are discussed together with methods of their detection and techniques for circumventing a failed capacitor in a Marx generator. Marx switch faults and timing irregularities are also discussed. A specific design for a high voltage fuse for use in Marx generator circuits which was developed and tested is presented. A cascade high voltage switch is discussed.

Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; High Voltage; Electric Switches

Secondary Keywords: NTISDODAF

7810

(BREAKDOWN STUDIES)

(Gas; Electrical)

INDUCED RADIAL VELOCITY IN NONSTATIONARY ELECTRIC ARCS

R.L. Phillips
University of Michigan, Ann Arbor, MI

Proceedings Of The IEEE, Vol. 59, No. 4, pp 466-473 (04/1971).

An analysis is presented of the effects of induced radial velocity on the thermal behavior of a nonstationary electric arc. An interrupted DC arc is simulated by treating the linearized equations for a cylindrical plasma, initially at a uniform temperature, when the wall temperature is suddenly changed by a small amount from the gas temperature. Due to compressibility, a radial wave motion is set up within the gas which causes rapid interior temperature changes on a time scale much smaller than the conduction time constant. For example, in a 5-mm-diameter SF₆ sub 6 arc, which is initially at a temperature of 11000 Deg K, the central temperature will change by 20 percent in 1 microsecond, while the conduction time constant is 100 microseconds. The possible importance of this behavior for circuit breaker arcs is discussed. 12 Refs.

Primary Keywords: Nonstationary Arc; DC Arc; Theory; Cylindrical Geometry; Wall Cooling; Radial Motion; SF₆ sub 6 Arc

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

7811

(BREAKDOWN STUDIES)

(Gas; Electrical)

INFLUENCE OF DIFFUSION AND NONEQUILIBRIUM POPULATIONS ON MOBILE-GAS PLASMAS IN ELECTRIC ARCS

J.F. Uhlenbusch and E. Fischer
The Technical University, Daechen, FRG

Proceedings Of The IEEE, Vol. 59, No. 4, pp 578-587 (04/1971).

Measurements and calculations of temperature, densities, and field-strength-current characteristics of cascade arcs burning in noble gases under atmospheric pressure are reported. The evaluation of measured arc data assuming Saha equilibrium, complete local thermal equilibrium (LTE), is not in agreement with the detailed solution of the balance equations. Solutions of these equations are compared with results following from measured line intensities only solving the rate equations in connection with the electron energy balance and the equation of state. For helium, both methods give results which agree within a few percent. The deviations from Saha equilibrium are caused by diffusion and the overpopulation of ground state atoms. The excited atoms, however, are nearly in equilibrium with the electrons. The ratio of electron densities reached in our experiment (parallel LTD) to measured E-I characteristics agree with calculated data; if diffusion is taken into account. A simple criterion for the limit between diffusion-dominated plasma and a plasma in thermal equilibrium is derived. 19 Refs.

Primary Keywords: Noble Gas Breakdown; Atmospheric Pressure; Temperature Measurement; Experiment; Theory; Saha Equations

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

7812

(INSULATION, MATERIAL; BREAKDOWN STUDIES)

(Gas; Gas; Electrical)

INSULATION PROPERTIES OF COMPRESSED ELECTRONEGATIVE GASES

F.R. Howard

Proceedings Of The IEE, Vol. 104, Part A, No. 14, pp 123-130 (04/1957).

The breakdown voltages of several gases are determined for AC, DC, and impulse voltages and for RF in this paper. Among the gases tested are SF₆ sub 6, CF₄ sub 4, CF₄ sub 3C, and CF₄ sub 2 Cl₂ sub 2.

Several field configurations were used, gas pressure was varied, and the experiments were conducted both with and without ionizing radiation present. 35 Refs.

Primary Keywords: Gas Insulation; Dielectric Strength; Gas Breakdown; Several Gases; SF₆ sub 6/Gas; Fluorocarbon Gases; DC Voltage; AC Voltage; Impulse Voltage; Radiation

COPYRIGHT: 1957 IEE

7813

(BREAKDOWN STUDIES)

(Gas; Electrical)

IONIZING GAS BREAKDOWN WAVES IN STRONG ELECTRIC FIELDS

R. Klingbeil, D.A. Tidman and R.F. Fernsler

University of Maryland, College Park, MD 20742

The Physics Of Fluids, Vol. 15, No. 11, pp 1969-1973 (11/1972).

An analysis of ionizing potential waves is made which includes photoionization. It is found that photoionization plays an important role in the avalanche propagation. Velocities, electron densities, and temperatures are given as a function of electric field for both negative and positive breakdown waves in nitrogen. 11 Refs.

Primary Keywords: Ionizing Potential Wave; Avalanche Breakdown

Photoionization; Avalanche Velocity; Nitrogen Gas

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7817
(BREAKDOWN STUDIES)

(Liquid, Electrical)

OBSERVATIONS ON THE INTERMITTENT ELECTRON EMISSION IN LIQUEFIED NITROGEN
Y. Murooka

Defense Academy Of Japan, Kashirimizu, Yokosuka, Japan

Journal Of Applied Physics, Vol. 48, No. 1, pp 136-142 (01/1977).

The prebreakdown mechanism in liquefied nitrogen has been studied by using a modified optical Schlieren system. The present method has the advantage of observing the drift velocity of the disturbance in liquids and the prebreakdown mechanism by using a small disk instead of a knife edge. Thus the disturbance occurring due to the charge carriers can be recorded on the screen with an intensity which is proportional to the rate of the refractive index change. The mobilities of the negatively charged carriers derived from the drift velocity of the disturbance fall in the range of 1.1×10^{-2} to 1.85×10^{-3} cm²/V sec) in liquefied nitrogen, and also that of the quasi-free electrons localized in the tiny bubbles (7.95×10^{-4} cm²/V sec) as calculated theoretically. 17 Refs.

Primary Keywords: Liquid Nitrogen Breakdown; Prebreakdown Mechanism
Schlieren Diagnostic; Disk Beam Obstruction; Charge Carrier Mobility; Gas Bubbles

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7818
(BREAKDOWN STUDIES)

(Gas, Electrical)

PREDICTION OF CONDITIONS FOR A SINGLE PULSE DISCHARGE

P.M. Sherman

University of Michigan, Ann Arbor, MI

Journal Of Applied Physics, Vol. 48, No. 1, pp 143-144 (01/1977).

An empirical method is presented for the prediction of conditions necessary to obtain a single pulse discharge with no oscillation, no restrike, and no residual energy storage. An RC circuit with a 16.7-microfarad capacitor charged to voltages between 2000 and 20000 V and discharging through wires of different metals was employed to obtain necessary conditions. It is shown that specific resistivity and specific heat of fusion of the wires can be used to predict the charge voltage necessary for the single pulse discharge for a given system. 13 Refs.

Primary Keywords: Single Pulse Discharge; No Oscillation; No Restrike;
No Residual Energy; RLC Circuit; Capacitor Charging
Circuit

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7819
(BREAKDOWN STUDIES)

(Gas, Electrical)

PRINCIPLES OF ARC MOTION AND DISPLACEMENT

H.H. Maescker

Universität München, Munich, FRG

Proceedings Of The IEEE, Vol. 59, No. 4, pp 439-449 (04/1971).

It is shown that the motion of an arc being described as a temperature cloud can be divided into two parts, one being the relative velocity of the arc phenomenon with respect to the mass flow and the other the mass motion itself. The first relative motion is determined by the equation for the change of internal energy with time, the second mass flow has to be calculated by means of the magnetohydrodynamic and continuity equations. Three groups of obstacles are given in each of which one of the three velocities disappears. In the first group, no mass flow exists and the motion of the arc is caused by various types of inhomogeneous heating. In the second group, the arc itself does not move due to the opposing effects of mass motion and relative arc motion. In the last group, the arc follows the mass flow without relative motion. As long as the boundary conditions do not change from the standpoint of the arc the motion continues steadily. If, however, the boundary conditions form any type of obstacles, a displacement occurring. 12 Refs.

Primary Keywords: Arc Motion; Arc Velocity; Mass Velocity; Theory;
Energy Balance; Magnetohydrodynamic Mass Flow;
Boundary Condition

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

7821
(BREAKDOWN STUDIES)

(Surface Flashover)

PULSED FLASHOVER OF INSULATORS IN VACUUM

D. Milton

Sandia Labs, Albuquerque, NM 87115

IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 1, pp 9-15 (03/1972).

Dielectric specimens in the shape of a frustum of a cone were evaluated for surface flashover strength in vacuum of 10^{-5} Torr. Data were obtained for positive and negative pulses of several hundred kilovolts amplitude and with rise times in the nanosecond and microsecond region. The results indicate that most materials exhibit a greater resistance to breakdown if the base of the cone is at the cathode and that the strength is greatly affected by the angle that the dielectric makes with the applied field. Lucite, polystyrene, polyethylene, cast Nylon, and 7760 glass are shown to be relatively resistant to flashover, in comparison with the ceramics and molded plastics. It is also observed that the surface flashover strength in vacuum is a small fraction (approximately 1/10 or less) of the volume strength and consequential breakdown through the bulk seldom occurs. Data are given for several common insulating materials. 13 Refs.

Primary Keywords: Surface Flashover; Vacuum; Lucite; Polystyrene;
Polyethylene; Nylon; Glass; Field Angle; 100 KV Test
Voltage

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

7822
(BREAKDOWN STUDIES)

(Electrodes, Recovery)

REFRACTORY ELECTRODE REGION RECOVERY FOLLOWING ARC INTERRUPTION

K.G. Evans, DC Strachen and H. Edels

University of Liverpool, Liverpool, UK

Proceedings Of The IEEE, Vol. 59, No. 4, pp 525-534 (04/1971).

Measurements are presented of the voltage fall across the electrode region of low-current carbon arcs when test current pulses are injected through the arc gap at some time (less than 100 microseconds) following rapid removal of the arc current. The results thus shed some light upon the thermal reignition phenomena of refractory electrodes. A model is proposed to describe the observed behavior at low injection current levels. This model may also be of assistance in describing the behavior of hot probes in high-pressure plasmas. Although the model is not extended to high current levels, a discussion is presented of the electrode region behavior for currents at which mechanisms apparently form, which are necessary for reignition and steady-state conduction through the electrode regions. 11 Refs.

Primary Keywords: Gas Discharge; Carbon Electrodes; Arc Interruption;
Recovery Processes; Voltage vs Current

Secondary Keywords: Plasma Probe

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

7823
(BREAKDOWN STUDIES)

(Gas, Electrical)

SPECTROSCOPIC STUDY OF HIGH CURRENT DISCHARGES

T. Ito, Y. Ueda, H. Komura and T. Mitto

Mitsubishi Electric Corp., Amagasaki, Japan

Proceedings Of The IEEE, Vol. 59, No. 4, pp 573-577 (04/1971).
A high current arc was developed between carbon electrodes in H_{2} at 27, SF₆ at 6, He, Ar, and air at an initial pressure higher than 1 atm. The current peak was above 5 kA and the duration of the plasma was 250 microseconds. The temporal and spatial changes of plasma parameters were measured by timer-resolved spectrography and high-speed framing camera. The electron density of the plasma was estimated from the Stark broadening of the lines $H\alpha$ at 6563 Å, C 4267 Ångström, He I 6671 Ångström, and He I 5876 Å. Our observations show the following: The arc space is divided into two regions, the bright narrow core and the broad outer flame. The electron density of the core is estimated to be of the order of 10^{18} cm^{-3} and an electron temperature of the order of 10^6 Deg.K is obtained at current peak. Even after current zero, the electron density keeps the order of 10^{17} cm^{-3} regardless of the kind of gas. 8 Refs.
Primary Keywords: High Pressure Discharge; 5 KA Current; 250
Microsecond Duration; Spectroscopy; Framing Camera;
Electron Density

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

7827
(BREAKDOWN STUDIES; SWITCHES, OPENING)

(Gas, Electrical; Mechanical)

THE TIME CONSTANT OF HIGH VOLTAGE CIRCUIT BREAKER ARCS BEFORE CURRENT ZERO

J. Urbanek

Brown, Boveri & Co Ltd, Baden, Switzerland

Proceedings Of The IEEE, Vol. 59, No. 4, pp 502-508 (04/1971).

It has been shown that the relative rate of decrease of conductance of the arc, in the following called RRDC, can be split in terms depending on the changing of the quantities: arc length, arc cross section, peak arc temperature and temperature profile, and the order of magnitude of the different terms has been estimated. For an experimental air blast breaker current and voltage near current zero have been measured for the case of a short line fault and the RRDC function has been calculated in the time interval 20-100 microseconds before current zero. It has been shown that the Cassie theory of Mayr is not applicable over the whole of the investigated time interval and also that the theory of Cassie does not apply in the time interval preceding 10 microseconds before current zero. In the last 10 microseconds before current zero, Cassie's theory describes the investigated air blast breaker quite well. The transient behavior of the arc conductance (e.g., Cassie's time constant) in the air blast breaker has been found to be of the same order of magnitude (approximately 0.5 microseconds) as has been reported for SF₆ gas blast breakers. This has been explained by the fact that the RRDC function is mainly dependent on the variation in the arc cross section, which seems to be only slightly dependent on the quenching medium. Because this reasoning is only valid before current zero, greater differences of the transient arc behavior of different breakers may occur at and after current zero. 7 Refs.

Primary Keywords: Air-blast Circuit Breaker; Conductance; Temporal
Resolution; Variable Length; Variable Cross Section

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

7836
(BREAKDOWN STUDIES)

(Gas, Optical)

CHARACTERISTICS OF LASER-INITIATED IONIZATION CHANNELS IN AIR

R. Fernsler, I.M. Vitkevitch, A.W. Ali, J.R. Greig, R.E. Pachacek and
M. Raleigh

Naval Research Lab, Washington, DC 20375

1977 IEEE International Conference On Plasma Science, pp 63 (05/1977).

The production of ionized channels in air has many applications such as the understanding and controlling of lightning, switching in high pressure gasses and propagation of electron beams. Initiation and direction control are common requirements in these applications. Among the methods for producing the ionized channels is the use of intense laser beams. Such beams form intermediate ionization channels. Sufficiently strong superimposed electric fields lead to discharges that produce uniform ionization channels. Characteristics of these types of ionization channels have been studied to determine the channel length and electrical properties as a function of laser parameters. 3 Refs.

Primary Keywords: Uniform Ionization Channel; Channel Length;
Electrical Properties

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

7845
(BREAKDOWN STUDIES)

(Exploding Wires)

ELECTRICALLY EXPLODED WIRES-EXPERIMENTS AND THEORY

J.B. Langworthy, R.C. O'Rourke, M.P. Shuler, I.M. Vitkevitch, C.B.
Dobbie, R.J. Veith and D.F. Hansen

Naval Research Lab, Washington, DC 20375

NRL Report No. 5489 (06/1960).

Availability: AD 258144 NTIS

This report theoretically traces the absorption of electrical energy by the wire and the behavior of the wire as its energy content is increased. Several simplifying assumptions are made to make the problem tractable while retaining physical significance. The application of exploding wires to soft X-ray production is discussed. An extensive description is given of the NRL exploding wire laboratory with mylar, water, and combination mylar-water capacitors characterized. 0 Refs.

Primary Keywords: Exploding Wire; Soft X-ray Production; Water
Capacitor; Mylar Capacitor; Mylar-Water Capacitor;
Experiment; Theory

7874
(ENERGY STORAGE, MECHANICAL)

PULSED HIGH VOLTAGE AND HIGH CURRENT OUTPUTS FROM HOMOPOLAR ENERGY STORAGE SYSTEM
R.D. Ford, D. Jenkins, W.H. Lupton and I.M. Vitkovitsky
Naval Research Lab., Washington, DC 20375
Memorandum rept. No. NRL-MR-4433, 16p (02/1981).
Availability: AD-A094 918/7
NTIS

Large energy storage capability of inertial-inductive systems provides an attractive option for satisfying the pulse power requirements associated with such applications as plasma confinement and heating, electromagnetic projectile acceleration and with production of intense radiation. These applications require high rate of energy delivery to the load at specific current and voltage levels. In conjunction with self-excited homopolar generator current source, an opening technology has been developed to provide up to 1 MJ of pulsed energy, alternately, at hundreds of kilovolts or at megavolts as well. The overall system efficiency, that depends sensitively on the load requirements, was measured over a range from 10% to more than 90% for different pulser-load circuit arrangements.

(Author): Primary Keywords: Pulse Generators; Electromagnetic Pulses; Plasma Generators; High Voltage; Prototypes; Efficiency; Heating; Plasmas(Physical); Confinement(General); Energy Transfer

Secondary Keywords: Homopolar Generators; High Current; NTISDODXA

7880
(INSULATION, MATERIALS)

(Liquid)

LIQUID MOTION AND INTERNAL PRESSURE IN ELECTRICALLY STRESSED INSULATING LIQUIDS

J. S. Mirza, C.W. Smith and J.M. Calderwood
University of Salford, Salford, UK

Journal Of Physics D: Applied Physics, Vol. 3, pp 580-583 (03/1970).
The electrical conductivity of hexane and transformer oil was found to be reduced by filtering the liquid through filters of pore size down to 10 nm, whereas no change in the liquid motion under the applied electric stress could be detected. It is concluded that a part of the measured conductivity is due to the charge carried by particles and that the particles are not the main cause of the liquid motion. Effects of the pressure developed in electrically stressed insulating liquids and of cavitation at the electrodes are discussed. At high fields, liquid jet motion from a point electrode is reported and evidence suggests that the charge in the jet may be carried within a spray of bubbles produced by cavitation at the electrodes. 11 Refs.

Primary Keywords: Insulating Liquids; Hexane; Transformer Oil; Conductivity Measurements; Liquid Circulation Measurement; Cavitation Effects

COPYRIGHT: 1970 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

7900
(PARTICLE BEAMS, ELECTRON)
(Reviews)

ELECTRON BEAM FUSION PROGRESS REPORT APRIL THROUGH SEPTEMBER 1977

Authors Unknown
Sandia Labs, Albuquerque, NM 87115
Sandia Report No. SAND78-0080 (04/1978).
Availability: SAND78-0080
NTIS

This report provides an overview of the progress made on the electron beam fusion program at Sandia laboratories from April through September 1977. Results from Proto II and the superfast Z-pinch experiment are presented along with theoretical studies of the physics power flow and e-beam generation. Refinements in the design of EDEFA are also discussed. 157 Refs.

Primary Keywords: Electron Beam Fusion; Magnetic Insulation; Marx Generator; Trigatron; Vacuum Diode; Vacuum Flashover

Secondary Keywords: Diagnostics

7901
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH REPETITION RATE SPARK GAP

Authors Unknown
MLR Report No. MLR-669 (03/1977).
Availability: UCRL 13718
NTIS

The design construction, and testing of a high repetition rate spark gap are described. The gas flow control, the high voltage trigger generator, the Blumlein charging system, and the proper control of these components are discussed. Lack of working equipment and funds limited the project so that the finished spark gap could only produce three pulses at 1 ms intervals with an amplitude of 1.4 kV. 6 Refs.

Primary Keywords: Field Distortion Gen; Rep-Rated; Blumlein Line; Triggering; Diagnostics

7902
(PARTICLE BEAMS)
(Generation)

A NEW COLLECTIVE PARTICLE ACCELERATOR

M. Friedman
Naval Research Lab., Washington, DC 20375
NRL Report No. NRL 3724 (02/1978).
Availability: AD A053759/7
NTIS

A simple novel mechanism for a collective particle accelerator is proposed. It is suggested that a density-modulated intense relativistic electron beam propagating in a spatially modulated magnetic field can drag particles (electrons or ions) and accelerate them to high energies. This new mechanism can generate high particle current. A strong radial electric field exists in the mechanism ensuring radial confinement of the accelerated ions. 12 Refs.

Primary Keywords: Electron Acceleration; Ion Acceleration; Heavy Ion Acceleration; Collective Acceleration

7903
(ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING)
(Systems; Explosive Fuses)

INDUCTIVE CHARGING OF PULSE LINES IN 0.1 TO 1.0 MJ RANGE USING FOIL FUSES STAGED WITH EXPLOSIVELY ACTUATED SWITCHES
D. Conte, R. Ford, W.H. Lupton, J.D. Shipman Jr., P. Turchi and I.M. Vitkovitsky
Naval Research Lab., Washington, DC 20375
NRL Report No. NRL 3672 (03/1978).
Availability: NTIS

The use of inductive storage techniques to replace the conventional high voltage sources, such as Marx generators, for the charging of high voltage transmission line pulse generators (i.e., capacitive loads) is discussed. The proposed opening switch system consists of exploding foil fuses staged with high explosive actuated switches. The low resistance of the explosive switches in the closed stage allows the inductive store to be charged at relatively slow rates without significant energy loss. Upon opening, current is commutated to the foils which rapidly explode to generate the inductive voltage necessary to charge the load. A detailed analysis of fuse performance, the basic inductive storage circuit, is presented, and empirically obtained data on the resistivity vs. dissipated energy characteristic of vaporized aluminum foils. The results are used to outline the design of inductive storage systems for pulse charging capacitors to 1 MV at energies from 100 to 1000 kJ, with rise times of 2 to 10 microseconds (1E11 to 1E12 W rate) and efficiencies of 20 to 65%. 17 Refs.

Primary Keywords: Inductive Storage; Fuses; Current Interruption; Pulse Charging Capacitors; Transmission Line Pulse Generators

7904
(DIAGNOSTICS AND INSTRUMENTATION; SWITCHES, OPENING)
(Miscellaneous; Explosive Fuses)

INTERPRETATION OF X-RAY LINE SPECTRA FROM EXPLODED-WIRE ARRAYS
P. Burkhardt (1), J. Davis (1), J. Rauch (2), M. Clark (2), G. Denbigh (3) and R. Scheidegger (3)
(1) Naval Research Lab., Washington, DC 20375
(2) Maxwell Labs Inc., San Diego, CA 92123
(3) Physic International Co., San Leandro, CA 94577
NRL Report No. NRL 3723 (03/1978).
Availability: NTIS

Temperatures and densities were determined from the plasma implosion formed at the center of symmetrical exploded-wire arrays. Temperatures of 500-850 eV were found from line ratios in Al and Si shots using various plasma models. The recombination temperatures for these elements were 400-500 eV. Higher implosion temperatures of 1.5 to 2 keV were found in Ti and Fe shots and of 2.5 to 4 keV for Fe wire shots. The densities were approximately $1E20 \text{ cm}^{-3}$ for the spatially-integrated implosion region. Intense emitting regions of approximately 300 micron in size were observed in densitometer contours of Al plasma pinhole images. 13 Refs.

Primary Keywords: X-ray Spectra; Exploded-wires

7905
(SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Explosive Fuses; Miscellaneous)

SPECTROSCOPY AND X-RADIATION FROM EXPLODED-WIRE ARRAYS AND GAS PUFF PLASMAS

P. Burkhardt and J. Davis
Naval Research Lab., Washington, DC 20375
NRL Report No. NRL 3534 (03/1979).
Availability: AD-A072 018/55
NTIS

In this report results are presented for three separate experiments involving multiple exploded-wire arrays and puff gas plasmas. The first section deals with the analysis and interpretation of x-ray line spectra from a variety of exploded multiple-wire arrays including Al, glass, Ti, SS, Mo, and W wires. The second section deals with x-ray spectra from a gas puff Z-pinch device, operated at the University of California, Irvine, that provides both spatial and spectral information of Ar x-ray emission. 25 Refs.

Primary Keywords: Exploding Wire Arrays; Wire Plasmas; Gas Puffs; Spectroscopy

7906
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON; DIAGNOSTICS AND INSTRUMENTATION)

(Generation; Transport; Miscellaneous)
INTENSE ELECTRON BEAM GENERATION AND COMPRESSION

R. Ecker, W. Buck, T.T. Young, D. Lopez and S. Chao
Physic International Co., San Leandro, CA 94577

DMA Report No. DMA 6523F (01/1978).

Availability: AD A059715
NTIS

Intense electron beam generation and compression in a converging magnetic guide field has been studied experimentally and theoretically. Beams from the QWL II generator with peak parameters of typically 350 kA, 1.2 MeV, and 120 nsec (FWHM of power pulse) have been diagnosed before and after factor-of-three area compression, using a newly constructed multi-collector Faraday cup for current density profile measurements, and multi-layered or filtered Faraday cup for time-resolved electron angle measurements and time-integrated charge collection. Ion profile measurements with ion optics were successfully used at dose level up to about 4000 rad. The effect of reflected electrons on diode behavior has been examined and found to be non-negligible for certain target configurations. Experimental results have been used to test the calculations of the REEFER diode code and of the new code, REFLEX, which was developed in this program to evaluate compressed-beam transport according to the Young-Spence model. 13 Refs.

Primary Keywords: Pulsed Electron Beams; High Dose; Beam Compression; Faraday Cup; Beam Transport Efficiency; Beam Current Profile; Diode Code (REEFER); Transport Code

7907
(PARTICLE BEAMS; ION)
(Generation)

ELECTRODE EROSION PROCESSES IN PULSED PLASMA THRUSTERS
D.J. Palumbo, M. Begun and W.J. Gunman
Fairchild Industries Inc., Farmingdale, NY 11735
AFRL Report No. AFRL-TR-79-14 (03/1979).
Availability: AD A069276
NTIS

During the course of this program it was determined that material melting is the primary physical phenomenon leading to erosion of the anode electrode. Experimentation with various materials indicated that minimum erosion of the anode was obtainable using Poco Graphite but significant impulse bit reduction due to the high resistivity of this material would be incurred if this material were used. The material yielding the next least amount of anode erosion was shown to be copper (OMFC). Various modifications in the thruster propellant/electrode configurations were attempted using Graphite in attempting to reduce the loss of thruster performance associated with the use of this material as an anode electrode. These attempts were unsuccessful, and the decision was made to move through the program to concentrate on minimizing the effects of the arched load on a copper anode surface by reconfiguring the electrodes and/or propellant rods. This approach to the problems not only led to a successful solution of the anode erosion problem, but also resulted in improved thruster performance and the capability of storing sufficient propellant to meet a total impulse requirement far in excess of the program goal using the original helical rod storage system with modified propellant rod width. 9 Refs.

Primary Keywords: Plasma Propulsion; Electrode Erosion; Arc Discharges

Secondary Keywords: Electric Propulsion; Space Propulsion

7908
(INSULATION, MATERIAL)
(Liquid)

FLUID DIELECTRIC CUTS SIZE AND WEIGHT OF HIGH-POWER AIRBORNE EQUIPMENT.
IT'S PARTICULARLY EFFECTIVE WITH HIGH-FREQUENCY RADIO AND RADAR
TRANSMITTERS

L.K. Findley
Electronic Communications, Inc., St. Petersburg, FL 33733
Electronic Design, Vol. 18, No. 26, pp 44-45 (12/1970).

The use of dielectric fluid instead of air in high-power airborne equipment is proposed. Higher dielectric strengths, lower operating temperature, and other advantages are discussed. The potential disadvantage of the temperature dependence of the dielectric constant is addressed. 6 Refs.

Primary Keywords: Silicon Oil; High Dielectric Strength; Good Heat Transfer; Lubrication

Secondary Keywords: Airborne Equipment

COPYRIGHT: 1970 HAYDEN PUBLISHING CO., INC.

7909
(INSULATION, MATERIAL)
(Solid)

A NOVEL CONDUCTING GLAZE

E.A. Dancy
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
Ceramic Bulletin, Vol. 55, No. 6, pp 569-571 (06/1976).

Molybdenum disilicide is used as the conducting material in a conducting glaze with a very small temperature coefficient of resistance. Resistances of 1E4 to 1E5 ohm/square were easily obtained, and resistances of 1E6 to 1E8 ohm/square were obtained when particle size and composition were carefully monitored. 7 Refs.

Primary Keywords: Conducting Glaze; Wide Conductivity Range; Good Stability

COPYRIGHT: 1976 AMERICAN CERAMIC SOCIETY

7910
(PULSE GENERATORS)
(Trigger)

HIGH-VOLTAGE PULSER SPARES BATTERY SUPPLY

W.J. Orr
National Research Council, Ottawa, Ontario, Canada

Electronics, Vol. 44, No. 1, pp. 58 (05/1971).

A design for a high-voltage pulse generator which drains little current from the batteries is presented. An inhot pulse is used to trigger the generator, and delays are variable between 0.5 and 20 microseconds. Pulses of 300V with a rise time of 30 nsec are generated. 8 Refs.

Primary Keywords: Battery Power; Low Duty Cycle; Monostable Multivibrator; Solid State; Low Jitter; Hundreds Of Volts Output

COPYRIGHT: 1971 McGRAW-HILL INC.

7911
(SWITCHES; CLOSING)
(Gas Gaps; Optical)

A SIMPLE LASER-TRIGGERED SPARK GAP FOR KILOVOLT PULSES OF ACCURATELY VARIABLE TIMING

B. Trevelyan
Fighting Vehicles Research and Development Establishment, Chertsey, Surrey, UK

Opto-Electronics, Vol. 1, No. 1, pp 62-63 (02/1969).

Results of the performance testing of both a solid- and gas-dielectric laser-triggered spark gap are presented. Both gaps exhibited no jitter and low delay. The air gap produced somewhat more distortion than the solid-dielectric switch, which utilized Melinex as the dielectric. 8 Refs.

Primary Keywords: Laser-triggered Spark Gap; Air Gap; Melinex Gap; Jitter Measurement

COPYRIGHT: 1969 CHAPMAN & HALL

7912
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Optical)

AN ELECTRICAL DISCHARGE THROUGH TWO LASER SPARKS
V.I. Vladimirov, O.M. Malyshev, G.I. Kazdebarin and V.V. Semenov
A.F. Ioffe Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR, Leningrad
Soviet Physics-Technical Physics, Vol. 13, No. 12, pp 1694-1695 (06/1968).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 2109-2111 (December 1968). In this paper it is shown experimentally that an electrical discharge can occur between two separate laser sparks. From shadow photographs it is established that the electrical discharge arises at the time when the hot regions of the two sparks come in contact in the process of expansion. For an electrode voltage of 550 V the electrical discharge takes place for distances between the centers of the laser sparks up to 10 mm. The resistance of the discharge gap agrees well with the value of the discharge resistance through one laser spark. 1 Refs.

Primary Keywords: Double Laser Spark; Spark Expansion; Spark Contact; Current Flow

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7915
(SWITCHES; CLOSING; BREAKDOWN STUDIES)
(Gas Gaps; Optical; Gas; Optical)

BREAKDOWN OF A SPARK GAP IN AIR TRIGGERED BY A LASER
Y. Miyoshi, T. Hosokawa and M. Shintani
Nagoya University, Nagoya, Japan
Japanese Journal of Applied Physics, Vol. 8, No. 5, pp 628 (05/1969).

In this paper, the self-breakdown voltage of a nonuniform field rod-plane gap is compared to the breakdown voltage of the same gap when irradiated with a giant pulse laser. The laser is focused on the plane electrode. The transition from corona self-breakdown to corona-less self-breakdown is studied and polarity effects of self-breakdown and laser-triggered breakdown are considered. 2 Refs.

Primary Keywords: Nonuniform Field Gap; Polarity Effects; Brass Electrodes; Formative Time Lag; Measurement

COPYRIGHT: 1969 THE PHYSICAL SOCIETY OF JAPAN

7918
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas; Electrical; Gas; Optical)

D.L. Franzén
National Bureau of Standards, Boulder, CO 80302

Journal of Applied Physics, Vol. 44, No. 4, pp 1727-1732 (04/1973). Continuous plasmas sustained by a focused high-power CO₂ laser are described. The power required for maintaining a cm plasma following preionization has been determined for Xe, Kr, and Ar, and attempted for Ne and He. Measurements indicate the noble gases with the lowest ionization potentials have the lowest sustaining thresholds. Relative properties of some of the plasmas were studied with a volumetric technique under certain conditions, more than half of the incident laser radiation was either backscattered or absorbed by the plasma. A major loss mechanism for the plasma is shown to be radiation in the visible and ultraviolet. Spectra of low-pressure Xe plasmas indicate the presence of ultraviolet transitions with a high contrast over the continuum. 8 Refs.

Primary Keywords: CO₂/Sub 2/ Laser; Preionized Plasma; Laser-maintained Plasma; Various Gases

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7924
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Optical; Gas Gaps; Optical)

INVESTIGATION OF BREAKDOWN IN N/SUB 2/ UNDER THE INFLUENCE OF A PICOSECOND RUBY-LASER PULSE

I.K. Krasavuk, P.P. Pashinin and A.M. Prokhorov
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR

Soviet Physics JETP Letters, Vol. 9, No. 10, pp 354-356 (04/1969). Trans. From: ZHETF Pis. Red. 9, 581-584 (May 1969)

Marked progress has been made by now in the generation and amplification of picosecond pulses of optical radiation. This extends greatly the experimental possibilities of studying optical breakdown in transparent media. Breakdown in gases can be produced, by varying the conditions of the experiment, both via the avalanche mechanism and by direct ionization of the atoms or molecules in the field of the strong light wave, whose frequency is much lower than the ionization potential. In the present study, we investigated the dependence of the breakdown threshold on the pressure in nitrogen gas at pressures from 2 to 165 mm Hg. The generation pulse duration ranged from 30 to 100 psec. 9 Refs.

Primary Keywords: Avalanche Breakdown; Threshold Intensity; Pulse Length Dependence

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7926
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Gas; Optical; Gas Gaps; Optical)

LASER INITIATED SPARK DEVELOPMENT IN AN AIR GAP

F.W. Lindner, W. Rudolph, G. Brummel and H. Fischer
Angewandte Physik, Technische Hochschule Darmstadt, Darmstadt, FRG

Applied Optics, Vol. 14, No. 12, pp 2225-2228 (09/1975). The authors utilize an image converter camera to follow the breakdown stages in a laser triggered spark gap. The phases seen were the production of a meta-vapor jet, prechannel (leader), filament, and breakdown. It is surmised that the prechannel is caused by field enhancement due to the cloud of metal vapor extending into the gap. 10 Refs.

Primary Keywords: Ruby Laser; Breakdown Phases; Light Emission From

Breakdown; Metal Vapor Jet

COPYRIGHT: 1975 THE OPTICAL SOCIETY OF AMERICA

7927
(PARTICLE BEAMS; ION; BREAKDOWN STUDIES)

(Generation; Solid; Optical) LASER SOURCES FOR MULTIPLY-CHARGED HEAVY IONS

G.F. Tonon
CEA Centre d'Etudes de Limeil, Villejuif-Saint Georges, France
IEEE Transactions On Nuclear Science, Vol. NS-19, No. 2, pp 172-183 (04/1972).

We present a review of the main results concerning the interaction between laser and matter; in particular the results concerning the state of charge, the energy and the spatial distribution of the plasma ions. From these results, we propose to use laser produced plasmas as sources of multiply-charged ions for heavy ion accelerators and we define the laser characteristics which would be required. 70 Refs.

Primary Keywords: Ion Source; High Ionization; Theory

COPYRIGHT: 1972 IEEE. REPRINTED WITH PERMISSION

7929
(SWITCHES, CLOSING)
(Vacuum Gaps, Optical)

A.S. Gilmour and R.J. Clark
Cornell Aeronautical Lab Inc, Buffalo, NY 14221
RADC Report No. RADC-TR-67-45 (02/1967).
Availability: AD 810505
NTIS

The feasibility of developing a laser-triggered switch for use in line-type modulator service at a voltage holdoff level of 300 KV and at a conduction current level of 1000 amperes is being investigated. To date, current peaks as high as 2000 amperes have been easily obtained. Using anode arcs (the laser-stimulated emitter at a positive potential with respect to the collector), a delay of approximately one microsecond occurs between the time when the laser illumination impinges on the emitter surface and the time when the maximum switch current occurs. The rise time of the leading edge of the current pulse has been observed to be about 100 nanoseconds, and was limited by the inductance of the external circuitry. In experiments performed to date, however, a fast (10 ns < 10 nanoseconds) pulse forming network has been constructed and will be used for future experiments. Pulse-length data indicate that operation in the 1 to 100 microsecond pulse-length range is easily achievable. Emitter life tests have shown that the life of the laser-triggered switch should be in excess of 1000 hours. Static voltage holdoff tests were conducted on the first high-voltage device, which after processing, withstood 300 kilovolts for an extended period. 0 Refs.

Primary Keywords: Vacuum Gap; Multichannel Kilovolt Operation; Fast Rise Time; Cathode Arc; Anode Arc

7931
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

L.L. Steinmetz
Lawrence Livermore Lab, Livermore, CA 94550

The Review of Scientific Instruments, Vol. 39, No. 6, pp 904-909
(06/1968).

A laser-triggered spark gap (LTSG) was developed to meet the need for producing a kilovolt electrical output pulse that is synchronous with the light output pulse of a Q-switched laser. The LTSG output pulse voltage is variable up to 12 KV, which value makes it useful for actuating Peckel cells. A theoretical explanation of the spark gap's triggering mechanism is developed. 4 Refs.

Primary Keywords: Dye Laser; Coaxial Spark Gap; Low Pressure; Thoriated Tungsten Electrode; Xenon Gap

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7932
(SWITCHES, CLOSING)
(Gas Gaps, Optical)

A.I. Babulin, B.I. Petrov, V.A. Rodichkin and A.M. Timonin
Soviet Physics-Technical Physics, Vol. 15, No. 8, pp 1335-1338
(02/1971).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 1718-1722 (August 1970). A spark gap in air ignited by the beam from a Q-spoiled ruby laser with a power of approximately 20 MW and a pulse length of approximately 30 nsec has been studied. Experimental relations have been found for the trigger time as a function of applied voltage, beam power, and the position of the focal plane of the focusing lens for two interelectrode distances. At a radiation intensity below the threshold for laser breakdown of the gas the best parameters are found when the ignition is focused on the cathode. The earliest trigger time for a gap 16 mm long is 25 nsec with a scatter of $\pm 4\%$; 3 nsec. The gap ignites satisfactorily in the range (0.25-1.0) $U_{\text{st}}/U_{\text{sub}}$, where U_{st} is the static breakdown voltage. 7 Refs.

Primary Keywords: Air Gap; Ruby Laser Delay vs Voltage; Delay vs Beam Power; Delay vs Focal Plane Position

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7934
(INSULATION, MATERIAL; REVIEWS AND CONFERENCES)

(Liquid; Reviews) AQUEOUS DIELECTRICS

J.B. Hasted
Birkbeck College, London, UK

Publisher: Chapman and Hall Ltd., London (01/1973).

The dielectric constant of water in several of its forms is the subject of this book. Pure water, ice, electrolytic and non-electrolytic solutions, and biomolecules, are all considered with the theory and many graphs and tables presented for each. Both dispersion and loss are addressed. A model is presented for the structure of ice and ice. In addition, the dielectric constants of several materials that contain absorbed water are presented. The dielectric properties and conductivity of moist soil, sand, snow, and naturally occurring ice are considered. Breakdown characteristics and electric strength are not addressed. 451 Refs.

Primary Keywords: Water Insulation; Dielectric Constant; Dispersion; Several Solutions In Water; Properties Of Absorbed Water

COPYRIGHT: 1973 J.B. HASTED

7935
(BREAKDOWN STUDIES)

(Gas, Electrical)

PECULIARITIES OF THE DEVELOPMENT OF THE ELECTRIC BREAKDOWN OF AIR IN EXTREMELY LONG DISCHARGE GAPS

G.N. Aleksandrov, B.N. Gorin, V.P. Radkov, I.S. Stakol'nikov and A.V. Shklyev
G.M. Krzhizhanovskii Institute, Moscow, USSR
Soviet Physics Doklady, Vol. 13, No. 12, pp 1246-1249 (06/1969).

Trans. From: Doklady Akademii Nauk SSSR 183, 1048-1053 (December 1968). The existing experimental data on the electric breakdown of air in long discharge gaps are limited to gaps 1-6 m long. It seemed desirable to undertake an investigation of the phenomenon in longer gaps. This would allow one to determine the tendencies in the modifications of the breakdown development which are associated with an increasing gap length. A knowledge of such tendencies has a considerable practical significance for problems involving the dielectric strength of air and is of interest for physics in general. This paper gives a brief account of the results of such an investigation, which has been conducted at the M.I. Kalinin Leningrad Polytechnic Institute and at the G.M. Krzhizhanovskii Power Institute. 3 Refs.

Primary Keywords: Meter Gap; Atmospheric Air; Breakdown Stages; Flashing Stage; Continuous Leader Stage; Through Stage; Light Emission Measurement; 10 A Currents

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7937
(BREAKDOWN STUDIES)
(Gas, Optical)

REVIEW OF GAS-BREAKDOWN PHENOMENA INDUCED BY HIGH-POWER LASERS-I
I.P. Shkarofsky
RCA Limited, Quebec, Canada
RCA Review, Vol. 35, pp 48-78 (03/1974).

This paper discusses the two optical breakdown mechanisms: multiphoton ionization and cascade ionization. The author begins with a short qualitative review of the theory of optical breakdown in gases, and proceeds to describe several experiments performed by several researchers which demonstrate the theory. Attempts are made to explain several anomalies in the results seen. The dependence of breakdown on several factors, such as spot size, impurity level and pulse duration is discussed. Laser maintained discharges are also considered. 71 Refs.

Primary Keywords: Laser Breakdown; Gas Composition; Impurity; Spot Size; Pulse Length; Pressure Dependence

COPYRIGHT: 1974 RADIO CORPORATION OF AMERICA

7939
(SWITCHES, CLOSING)

(Solid Dielectric, Optical)

SOLID-DIELECTRIC NANOSECOND SPARK GAP WITH LASER TRIGGERING
A.I. Babulin, V.A. Rodichkin, G.Ye. Rusekova and A.M. Timonin
Soviet Physics-Technical Physics, Vol. 16, No. 8, pp 1318-1320
(02/1972).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1675-1677 (August 1971). A solid-dielectric spark gap which is triggered by a Q-spoiled ruby laser is described. Using generated pulses with amplitudes as high as 15-20 KV and lengths of 2-3 nsec with rise times of 0.5-0.7 nsec. The response time of the spark gap is measured as a function of the voltage applied to various types of films with different thickness. The results are discussed. 7 Refs.

Primary Keywords: Ruby Laser; Delay Measurement; Various Dielectric Materials; Variable Thickness

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7940
(PULSE GENERATORS; SWITCHES, CLOSING)

(Capacitor Banks; Gas Gaps, Optical)

SOME DESIGN CONSIDERATIONS OF A LASER TRIGGERED IMPULSE GENERATOR
J.J. Bleeker and C.G. Morgen
(12/1965).

Availability:

NTIS

In a number of Divisions at CERN considerable interest is being taken in the possibility of the production of large current and high voltage impulse generators. This interest arises from requirements, for example, in the MPS and AR Divisions for work on kicker magnets, and in the NPA Division for basic research and development of particle separators. 10 Refs.

Primary Keywords: Review; Vacuum Electrode Emission; Electron Multiplication; Jitter Estimate; Ruby Laser

COPYRIGHT:

1972 IEE International Conference On Gas Discharge Proceedings, pp 6-10 (01/1970).

The spark discharge in an air gap can be triggered by a giant pulse laser beam focused on an electrode surface. This type of gap is called the Laser Triggered Spark Gap, which can meet the need for a high speed switch. Many design implications of this gap are discussed. An experimental study of the breakdown mechanism of the gap was performed. 4 Refs.

Primary Keywords: Ruby Laser; Air Gap; Electrode Irradiation; Breakdown Mechanism; Double Current Pulse

COPYRIGHT: 1970 IEE

7941
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas, Optical; Gas Gaps, Optical)

SPARK-DISCHARGE TRIGGERED BY A PULSE LASER BEAM

K. Morii, T. Noguchi and M. Yano
Electrotechnical Lab, Tokyo, Japan

IEE International Conference On Gas Discharge Proceedings, pp 6-10 (01/1970).

The spark discharge in an air gap can be triggered by a giant pulse laser beam focused on an electrode surface. This type of gap is called the Laser Triggered Spark Gap, which can meet the need for a high speed switch. Many design implications of this gap are discussed. An experimental study of the breakdown mechanism of the gap was performed. 4 Refs.

Primary Keywords: Ruby Laser; Air Gap; Electrode Irradiation; Breakdown Mechanism; Double Current Pulse

COPYRIGHT:

1972 IEE International Conference On Gas Discharge Proceedings, pp 6-10 (01/1970).

7943
(PULSE GENERATORS; ELECTROMAGNETIC FIELD GENERATION)

(Capacitive; Magnetic)

A COMPACT MAGNETIC-FIELD-PULSE GENERATOR

I.I. Usakov
Leningrad Technological Institute, Leningrad, USSR
Instruments and Experimental Techniques, Vol. 16, No. 8, pp 1797-1799
(12/1973).

Trans. From: Pribory i Tekhnika Eksperimenta 6, 154-156 (November-December 1973).

A simple device is described which generates monopolar magnetic field pulses having an intensity ranging from 4 to 2.5 MA/m for a discharge-current amplitude ranging from 4 A to 2.5 kA. The repetition frequency of the pulses may be controlled in the range from 25 to 0.5 Hz. The possibility is provided for the operation of the generator in a one-shot mode. The length of the magnetic field pulses at the base is approximately 160 microseconds; the discharge energy of the capacitor bank is <200 J. The stability of the amplitudes of the current and magnetic-field pulses is $\pm 0.05\%$. 7 Refs.

Primary Keywords: Pulse Generator; 4 A - 2.5 kA Current Range; 2.5 MA/m Field; Thyristor; Crowbar

COPYRIGHT: 1974 PLENUM PRESS. REPRINTED WITH PERMISSION

7948
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas, Optical; Gas Gaps, Optical)

TIME CONSTANTS OF SPARK DISCHARGES INITIATED BY A GAS-LASER BEAM OF LAMBDA = 0.3371 MICRONS

Yu.A. Kurbatov and V.F. Teranenko
Soviet Journal of Quantum Electronics, Vol. 2, No. 6, pp 567-568 (06/1973).

Trans. From: Kvantovaya Elektron 12, 108-109 (1972).

An investigation was made of the time constants of spark discharges initiated by a laser beam of $\lambda = 0.3371$ microns and 10 kW peak power. The experiments were carried out at pressures of 1-8 atm in a discharge chamber. The discharge gap was 1-10 mm and the applied voltage was 10-200 KV. The laser beam was directed onto a copper cathode through a grid-like anode. The discharge delay time varied depending on the conditions, from 1 to 100 nsec. The fluctuations of the delay time did not exceed ± 3 nsec even at voltages close to the static breakdown value. This high stability of the triggering of the discharge gaps indicated that the laser beam in question was a suitable source for initiation of high-power spark discharges. 4 Refs.

Primary Keywords: Nitrogen Laser; Variable Pressure; Variable Gap Spacing; Copper Electrode; Delay Measurement; Jitter Measurement

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7951
(SWITCHES; CLOSING)
(Gas Gaps; Optical)

12.2-LASER-TRIGGERED MEAVOLTA SWITCHING

A.H. Guenther and J.R. Bettis

AFML, Kirtland AFB, NM 87117

IEEE Journal of Quantum Electronics, Vol. QE-3, No. 11, pp 581-588 (11/1967)

Laser-initiated breakdown of high-voltage spark gaps has been extended to the megavolt range through the use of a novel coaxial triggering geometry. In this configuration a 180- to 250-megawatt ruby laser of 1.4- to 3.5-joules output was aligned along the interelectrode axis of the spark gap. The laser beam passed through a hemispherical electrode, mounted on a hollow shaft, and was focused by a lens internal to this electrode at the opposite switch electrode surface. Based on investigations of the effect of polarity on switch performance, i.e., least delay and jitter, it was concluded that 1) irradiation of the charged electrode was preferred and 2) irradiation of positive-rather than negative-charged electrodes gave best performance. Delay times between arrival of the laser pulse and complete gap closure as short as 2 ns with unmeasurable jitter (< 1 ns) were readily attainable under various conditions (high-pressure and high-reduced fields). By recourse to classical arc-breakdown theories, i.e., Townsend avalanche and streamer mechanism, it was concluded that the variation of delay with reduced field follows an avalanche process. However, for an explanation of extremely short delays observed (high-velocity closure rates), a streamer mechanism is necessary. 15 Refs.

Primary Keywords: Ruby Laser; Air Gap; Nitrogen Gap; Megavolt Operating Voltage; Single-channel Discharge; Experiment; Theory

COPYRIGHT: 1967 IEEE. REPRINTED WITH PERMISSION

7966
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

FIELD EMISSION: LARGE CURRENT DENSITIES, SPACE CHARGE, AND THE VACUUM ARC

M.P. Duke and J.K. Treloar

Linfield College, McMinnville, OR

Physical Review, Vol. 89, No. 4, pp 799-808 (02/1953).

Field emission was obtained from a single crystal tungsten emitter under conditions of very high vacuum and clean surfaces. The geometry of the emitter was determined by electron microscopy permitting accurate calculation of both the surface electric field and an average current density. The use of pulse electronic techniques extended the observations to the upper limit of the current densities for which the normal field emission was stable. Above this limit an explosive vacuum arc occurred between electrodes. From these experiments the following conclusions were drawn. (1) The wave mechanical, image force corrected theory quantitatively predicted the observed average current density up to that density of the order of $10^7 \text{ amperes/cm}^2$. Above this density marked deviation occurred from the usual current-voltage relationship. (2) Two distinct facts supported the simultaneous operation of multiple emitting areas in different geometries. (3) At a still higher critical current density, in the range to $10^8 \text{ amperes/cm}^2$, a field emission initiated vacuum arc occurred between electrodes resulting in a change of emitter geometry. Current density was the dominant criterion for the initiation of the vacuum arc. 25 Refs.

Primary Keywords: Field Emission; Tungsten Cathode; Clean Surfaces; Surface Electric Field; Emission vs Voltage; Vacuum Arc

COPYRIGHT: 1953 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION

7971
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Vacuum Gaps, Electrical)

INITIAL STAGES OF LOW-PRESSURE PULSE DISCHARGE

A.B. Boim and E.M. Reikhrudel

Moscow State University, Moscow, USSR

Soviet Physics-Techical Physics, Vol. 6, No. 9, pp 821-826 (03/1962). Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 1127-1134 (September 1961).

A study was made of the ignition of a pulse discharge in a tube containing a cold cathode with a trigger electrode at initial pressures of 10^{-4} - 10^{-6} torr and initial voltages 30-60 kV. A study of the current and voltage variation with time by oscillography and simultaneous measurement of the integral intensity of the x-ray emission of the discharge showed that ignition of the pulse discharge passes through a stage of predischARGE pulses prior to the stage of the gas-focused beam. The lifetime ($\tau_{\text{av}}/10^3$) of the predischARGE pulse stage with fixed initial conditions (capacitance and initial voltage of pulse generator, degree of outgassing of electrodes, pressure) depends on the emissive properties of the grid cathode; $\tau_{\text{av}}/10^3$ can be prolonged from one microsecond to several milliseconds by variation of the resistance ($R_{\text{av}}/10^3$) in the trigger-gap circuit. The investigated prolongation of ignition can be used for control of the duration (τ) of the electron-optical stage, which includes the above-mentioned stages of the pulse discharge. 9 Refs.

Primary Keywords: Vacuum Breakdown; Cold Cathode; Trigger Electrode; 10⁻⁶ Torr Pressure; 60 KV Voltage; Current Measurement; Voltage Measurement; Temporal Resolution

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

7974
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)

LOW-VOLTAGE FIRING CHARACTERISTICS OF A TRIGGERED VACUUM GAP

G.A. Ferrell

General Electric Co., Schenectady, NY 12301

IEEE Transactions On Electron Devices, Vol. ED-13, No. 4, pp 432-438 (04/1966).

The triggered vacuum gap is a normally nonconducting device in which a high-current metal-vapor arc can be established by a suitable pulse of current to a triggering electrode. While this gap is well suited to switching applications at high voltage, it has properties which make it useful at low voltage as well. The operation of the triggered vacuum gap has, therefore, been studied in the range of 100 to 1000 volts. It was found that, although the gap could be triggered with currents as low as 0.02 amperes, consistent triggering with firing delays less than a microsecond required trigger pulses of 10 amperes or more. Little or no dependence of firing time on main gap voltage was observed below a few hundred volts; however, the probability of establishing a stable main discharge with a short duration trigger pulse falls off rapidly with decreasing gap voltage. The polarity of the main gap voltage and of the trigger pulse strongly influenced the firing characteristics of the gap in the range studied. These effects are discussed in detail. 11 Refs.

Primary Keywords: Vacuum Spark Gap; Metal Vapor Arc; 100-1000 V Operating Voltage; Very Low Trigger Current; Delay Measurement; Jitter Measurement

COPYRIGHT: 1966 IEEE. REPRINTED WITH PERMISSION

7976
(BREAKDOWN STUDIES)
(Surface Flashover)

HANSECON TIME DEVELOPMENT OF A PULSED DISCHARGE AT A DIELECTRIC-VACUUM INTERFACE

S.P. Bugayev and G.A. Mesyats

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics-Techical Physics, Vol. 10, No. 7, pp 930-932 (01/1965). Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 1292-1294 (July 1965)

The time development of a discharge at a dielectric-vacuum interface must be studied to clarify the mechanism underlying the phenomenon and to facilitate the selection of vacuum insulation, the development of switching devices, electron tubes, etc. Breakdown at the surface of a dielectric in vacuum has not been studied adequately to date. The effect of various factors on breakdown voltage has been investigated previously; prebreakdown currents have also been studied, and the voltage-time characteristic have been studied in the microsecond range. However, the literature contains no information on the time required for breakdown to develop over a dielectric-vacuum interface so that it is difficult to explain the processes taking place during breakdown. 7 Refs.

Primary Keywords: Surface Flashover; Vacuum Environment; Flashover Voltage; Flashover Delay; Several Dielectrics; Semipermeable Conditioning

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8000

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

THE INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM

L. Cranberg

Los Alamos National Labs, Los Alamos, NM 87545

Journal Of Applied Physics, Vol. 23, No. 5, pp 518-522 (05/1952).

The hypothesis is suggested that initiation of high voltage breakdown in vacuum is due to traversal of the high voltage gap by a column of ionized material. The implication of this hypothesis for uniform-field gaps is that the breakdown voltage is proportional to the square root of the gap length. A summary of the literature is presented which supports this conclusion for a range of gas distance from 0.2 mm to 6 meters. Additional qualitative evidence is presented which tends to support the proposed hypothesis. 15 Refs.

Primary Keywords: Vacuum Breakdown; Uniform Fields; Microparticle; Breakdown Voltage vs Gap Spacing; Square Root Dependence; Literature Review

COPYRIGHT: 1952 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8009

(SWITCHES, CLOSING)

(Gas Gaps, Optical)

INVESTIGATION OF LASER PULSE FORMING BY LTSG AND POCKELS CELLS

K. Yoshioka, T. Yamamoto, T. Sasaki, K. Shimamura and C. Yamane

Osaka University, Suite, Osaka, Japan

Electrical Engineering In Japan, Vol. 92, No. 6, pp 117-122 (11/1972). Trans. From: Denki Gakka Ronbunshi 92C, 377-383 (November 1972)

This paper describes a laser-triggered gas gap used to switch a Pockels Cell for laser light switching. The gap is filled with an argon-nitrogen mixture with the laser focused on the cathode. Electrodes are stainless steel. The gap distance is adjustable. Graphs of delay vs. self-breakdown voltage, delay vs. electrode spacing, and rise time vs. electrode spacing are presented. 24 Refs.

Primary Keywords: Glass Laser; Argon Gap; Nitrogen Gap; Stainless Steel Electrode

8011

(BREAKDOWN STUDIES)

(Gas, Electrical)

SOME PROPERTIES OF HIGH CURRENT SPARK CHANNELS

C. Braudo and J.D. Craggs

University of Liverpool, Liverpool, UK

International Journal Of Electronics, Vol. 22, No. 4, pp 329-353 (06/1967).

Spark channels carrying currents of 200 kA were studied in hydrogen, argon, and helium at 760 Torr. Measurements were taken of the gap voltage drop, the gap resistance, the channel expansion velocities, and the current waveform. Other spark channel characteristics, such as the wave velocity, pinch temperature, drift velocity, ion and electron density, and channel resistance, are then calculated from the results. 26 Refs.

Primary Keywords: Spark Channel; High Current; Voltage Drop; Expansion Rate; Discharge Temperature

COPYRIGHT: 1967 TAYLOR & FRANCIS LTD.

8043

(BREAKDOWN STUDIES)

(Gas, Electrical)

DEVELOPMENT OF ELECTRON AVALANCHES AND STREAMERS

E.D. Loganski

Soviet Physics Usp. Vol. 18, No. 11, pp 893-908 (11/1973).

Trans. From: Usp. Fiz. Nauk 117, 493-521 (November 1973)

The article presents a review of the current state of the theory of avalanche-streamer processes, i.e., processes occurring during the development of discharges in dense gases. The principal attention is devoted to description of the physical picture of the phenomena. A systematic presentation is given of the theory of the main stages of formation of a discharge; the theory of electron avalanches, the theory of a self-maintaining discharge, the theory of the avalanche-streamer transition, and the theory of streamers. The question of breakdown of long spark gaps is discussed briefly. 126 Refs.

Primary Keywords: Review; Theory; Dense Gas; Discharge; Physical Picture; Self-maintaining

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8044
(BREAKDOWN STUDIES)
(Gas; Optical)

EFECT OF HIGH MAGNETIC FIELDS ON THE THRESHOLD OF LASER-INDUCED GAS BREAKDOWN

E.J. Button and A.H. Gauthier
AFRL, Kirtland AFB, NM 87117
Journal of Applied Physics, Vol. 47, No. 2, pp 522-530 (02/1976).
A quantum rate analysis of laser-induced breakdown in deuterium and helium gas was used to predict the dependence of the breakdown-threshold intensity on gas pressure, laser-pulse length, and the direction of propagation of the laser beam. Diffusion, elastic and inelastic collisions, and multiphoton ionization of atomic and molecular states excited by electron impact were considered. The threshold data indicate the presence of three distinct regions: the pulse-length dominated, intermediate, and the diffusion dominated, as well as the importance of a dimensionless parameter omega in determining the magnitude of the magnetic field effect on the breakdown threshold for a given set of experimental conditions. The results are in excellent agreement with experimental data. 36 Refs.
Primary Keywords: Laser-induced Breakdown; Helium; Threshold Intensity; Parallel Magnetic Field; Numerical Calculation; Experiment

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8045
(PARTICLE BEAMS, ELECTRON)
(Generation)

LOCALIZATION OF FIELD EMISSION IN SMALL SOLID ANGLES

G.N. Fursat and S.A. Shakirova
A.A. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 11, No. 6, pp 827-832 (12/1966).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1125-1131 (June 1966).
A field-emission cathode is a point source of electrons with very small linear dimensions (0.81 to 1 micron). This makes it possible to focus the electron beam by direct electron-optical methods and to simplify electron-optical systems significantly. These sources, however, exhibit spherical symmetry with a radially diverging beam. Thus, the aperture angle of the emitted cone is very large, being for average emission densities (10^4 - 10^5 A/cm²) approximately equal to 60 deg. and, for the limiting densities (10^7 - 10^8 A/cm²), approximately equal to 100 deg. In order to obtain a fine electron probe a very narrow pencil is usually isolated from the beam. The apertures necessary for ensuring the minimum permissible aberrations in the beam are to 10^{-3} - 10^{-2} rad. 17 Refs.

Primary Keywords: Field-emission Diode; Large Divergence; Collimating Aperture; High Losses; Selective Electron Emission

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8046
(PARTICLE BEAMS, ION)
(Generation)

PARTICLE ACCELERATION BY COLLECTIVE EFFECTS

D. Keefe
Lawrence Berkeley Lab, Berkeley CA
1976 Proton Linear Accelerator Conference, pp 352-357 (09/1976).
Successful acceleration of protons and other ions has been achieved experimentally in this decade by a number of different collective methods. The attainment of very high accelerating fields has been established although so far the acceleration distance has been confined to only a few centimeters. Efforts are in progress to understand the accelerating mechanisms in detail and, as a result, to devise ways of extending considerably the acceleration distance. This paper is intended to review the current progress, expectations, and limitations of the different approaches. 20 Refs.

Primary Keywords: Proton Acceleration; Ion Acceleration; Collective Effects; Review

COPYRIGHT: 1976 ATOMIC ENERGY OF CANADA

8047
(BREAKDOWN STUDIES)
(Gas, Electrical)

PHOTOPREIONIZATION OF THE 3371-ANGSTROM PULSED N₂/SUB 2% LASER

M.A. Kurnit, K. Bidhchand, L.W. Ryan Jr., A. Javan and S.J. Tubbs
Massachusetts Institute of Technology, Cambridge, MA
IEEE Journal Of Quantum Electronics, pp 174-176 (04/1975).
Photopreionization of the 3371-Ångström pulsed N₂/SUB 2% laser by use of a seed gas of low ionization threshold and flashlamp excitation is observed to result in increased laser output and reproducibility. Preionization also increases the range of possible operating pressures, enabling operation with atmospheric-pressure mixtures of N₂/SUB 2% and He without reduced intensity. 8 Refs.

Primary Keywords: Photopreionization; Flashlamp; Arc Suppression; Large Volume

Secondary Keywords: Nitrogen Laser Pumping

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

8049
(PULSE GENERATORS; SWITCHES, CLOSING)
(Systems: Gas Gaps, Electrical)

SUBNANOSECOND RISE TIME MULTIKILOVOLT PULSE GENERATOR

D.F. McDonald (1), C.J. Manning (1) and S.J. Brant (2)
(1) BDM Corp, El Paso, TX
(2) University of Texas at El Paso, TX
The Review Of Scientific Instruments, Vol. 36, No. 4, pp 504-505 (04/1965).

A multikilovolt nanosecond pulse generator has been developed which uses a new approach to the design of an extremely fast gas-discharge switch. The design concept is based on the statistical time lag which precedes an electrical breakdown. The generator also employs large coaxial geometry so that extremely high operating voltages may be used. A description of instrumentation required to measure the fast rise time, high voltage pulses is included along with some typical oscilloscope traces. 8 Refs.

Primary Keywords: Fast Rise, High Pressure Spark Gap; Pulse Forming Line; Statistical Time Lag

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8050
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

CHARACTERISTICS OF THE TRIGATRON SPARK-GAP

A.M. Sleatten and J.J. Lewis
Queen Mary College, London, UK

Proceedings of the IEE, Vol. 104, Pt. C, No. 5, pp 54-61 (03/1957).

The behaviour of a trigatron three-electrode spark-gap in air has been investigated and its characteristics obtained with particular reference to its use as a controlled high-voltage switch. It is found that the voltage range over which it may be triggered satisfactorily depends, not only on the polarities of the main gap and triggering voltages, but also on the energy of the discharge. The breakdown time-lag is also determined by these same voltage polarities and also by the time-constant of the trigger discharge circuit. From these characteristics and certain other relevant observations, a theory of the breakdown process in such a spark-gap is suggested, involving the propagation front of a low-density easily-ionized region. Finally, a brief investigation on the successful use of a trigatron in a diverter circuit capable of diverting the discharge energy in a spark-gap subjected to direct and impulse voltages of 300 KV and in a circuit providing accurate 'chopping' of impulse voltage waves, is reported. 12 Refs.

Primary Keywords: Trigatron; Air Gap; Operating Characteristics; Voltage Operating Range; Trigger Polarity Dependence

COPYRIGHT: 1956 IEE

8051
(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

THE CHARACTERISTICS OF THE TRIGATRON SPARK-GAP AT VERY HIGH VOLTAGES

T.E. Broadbent

University of Manchester, Manchester, UK

IEE Monograph No. 364 M, pp 213-215 (03/1960).

Curves are given showing the working range and time-lag characteristics of a trigatron spark-gap working in air at voltages up to 1 MV. It is shown that, for voltages of this magnitude, a single-stage trigatron spark-gap of suitable design provides a simple and convenient method of chopping the voltage at any required instant. Factors which affect the performance of the gap are discussed. 7 Refs.

Primary Keywords: Trigatron; Operating Characteristics; Time Lag; Voltage Range; Air Gap; Geometry Dependence

COPYRIGHT: 1960 IEE

8052
(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

THE DEVELOPMENT OF THE DISCHARGE IN THE TRIGATRON SPARK GAP AT VERY HIGH VOLTAGES

T.E. Broadbent and A.H.A. Shish

University of Manchester, Manchester, UK

British Journal Of Applied Physics, Vol. 14, pp 687-691 (06/1963).

In the optical phenomena occurring during the initiation of breakdown in the trigatron spark gap in air have been investigated with voltages up to 100 KV and breakdown currents up to 60 mA using an image converter as an electro-optical shutter. Measurements of gap-current flowing during the breakdown initiation process have also been made. The optical phenomena are similar in nature to those occurring in long untriggered gaps. One or more leader strokes occur, followed by a main stroke. Leader stroke velocities fall within the range 560 to 3,288 cm/sec depending on experimental conditions. The average mainstroke velocity is about 168 to 185 cm/sec. Under certain conditions the path taken by the complete spark is partly governed by the production of a short leader stroke originating at one electrode. It is shown that this leader occurs only in the region of the gap where conditions laid down by Leob and Meek and Roather as being suitable for streamer formation and propagation are satisfied. 10 Refs.

Primary Keywords: Trigatron; Optical Observation; Gap Current Measurement; Leader Stroke; Main Stroke; Discharge Propagation Speed

COPYRIGHT: 1963 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8053
(BREAKDOWN STUDIES)

(Gas, Electrical)

ELECTRON EMISSION AT HIGH FIELDS DUE TO POSITIVE IONS

P. Kisliuk

Bell Labs, Murray Hill, NJ 07747

Journal Of Applied Physics, Vol. 30, No. 1, pp 51-55 (01/1959).

Two mechanisms have been proposed to account for the observed large yield of secondary electrons in gaseous breakdown at high electric fields. In one the choice is single ion in approaching the cathode surface creates "losses" by decreasing the width of the potential barrier. In the other, the increased positive-all fields due to a large number of ions in the gap is supposed to account for the increased emission. The first effect is re-examined and appears to be effective in the observed breakdown of extremely small gaps in air. It may also be effective in breakdown at high pressure and in liquid and solid dielectrics. 21 Refs.

Primary Keywords: Gas Breakdown; High-field Breakdown; Secondary Electrons; Cathode Effect; Potential Barrier Decrease; Ionic Field Increase

COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8054
(BREAKDOWN STUDIES)

(Electrodes)

FIELD-DEPENDENT SECONDARY EMISSION

H. Jacobs

ECOM, Fort Monmouth, NJ 07703

Physical Review, Vol. 84, No. 5, pp 877-884 (12/1951).

Experiments have been conducted with magnesium oxide surfaces in which high DC fields were applied to the surface, while at the same time secondary emission measurements were being made. Very high secondary emission ratios were obtained reproducibly (100 to 1 and greater). Under static conditions it was found that the ratios would increase exponentially with increasing fields. In addition, for constant fields, the ratio of liberated electrons to bombarding electrons was constant, over a wide range of bombardment energy. Measurements were made of secondary emission with a square wave field applied to the surface and time lag effects were noted. Decay time in the order of 30 microseconds were measured. The rise time was found to be dependent upon field and bombarding currents. The mechanism of field-dependent secondary emission was shown to be related to an avalanche effect, triggered by the bombarding electrons. 12 Refs.

Primary Keywords: Electron Emission; Secondary Emission; Magnesium Oxide Surface; High Secondary Emission; Exponential Variation With Field

COPYRIGHT: 1951 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8080
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
WHISKER GROWTH IN HIGH-VOLTAGE HIGH-VACUUM GAPS
L. Jedynak
Journal of Applied Physics, Vol. 36, No. 8, pp 2587-2589 (08/1965).

The verification by Little and Whitney of the existence of whisker-like microprojections on the cathode electrode of a vacuum gap offers strong support for the field-emission concept of prebreakdown currents and for the field-emission-initiated and clump theories of vacuum breakdown. The cathode whiskers correlate well with the electron beam discussions of Hailand and also match Dyke's description of breakdown due to vaporization of a field-emitting electrode. The clump theory and time lag of breakdown are both described in terms of microprojections as done by Denholm in his article. Growth of fracture of points in the vacuum gap. The existence of the microprojections or whiskers, supports the present belief that breakdown does not have a single primary cause, but is instead caused by any one of several mechanisms depending upon the local conditions existing within the gap. 8 Refs.

Primary Keywords: High-vacuum Gaps; Vacuum Breakdown; Cathode Whiskers; Clump Theory; Prebreakdown Current

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8081
(BREAKDOWN STUDIES)
(Gas, Optical)

CHANNELING OF AN IONIZING ELECTRICAL STREAMER BY A LASER BEAM
D.W. Koerner and T.D. Williamson
Varian Inc., Springfield, VA 22151

Journal of Applied Physics, Vol. 42, No. 5, pp 1885-1886 (04/1971).
Long electrical spark discharges have been directed through air along predetermined paths defined by a concentrated laser beam. At apparent optical power densities of 50-100 MW sq.cm., 35-nsec half-width laser pulses at 10.6 microns have been effective in channeling streamer discharges from a 350-kv positively charged electrode for distances up to 26 cm in a total streamer length of 71 cm. The average E-field required to obtain a discharge between electrodes was reduced from 7.3 to 5.5 kV/cm with the laser power employed. 12 Refs.

Primary Keywords: Laser Channeling; Directed Discharge; Long

Distances; Low Level Ionization; By Laser

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8083
(PARTICLE BEAMS, ELECTRON)

(Reviews)

ELECTRON BEAM FUSION PROGRESS REPORT OCTOBER 1976 THROUGH MARCH 1977
Authors Unknown
Sandia Labs, Albuquerque, NM 87545

Sandia Report No. SAND77-1414 (10/1977).

Availability: SAND77-1414
NTIS

This report provides an overview of the progress made on the electron beam fusion program from October 1972 through March 1977 at Sandia Laboratories. The authors begin with a review of the concept of the EBFA and proceed to briefly discuss the progress made and problems encountered in the development of vacuum insulation systems, Marx generators, intermediate energy stores, switches, and diode construction. Predicted target interactions and projected diagnostics are also discussed. 126 Refs.

Primary Keywords: Electron Beam Fusion; Magnetic Insulation; Marx

Generators; Trigatron; Vacuum Diode; Vacuum Flashover

Secondary Keywords: Diagnostics

8084
(POWER CONDITIONING)
(Saturable Reactors)

MAGNETIC SWITCHES AND CIRCUITS
W.C. Munnally

Los Alamos National Lab., Los Alamos, NM 87545

Los Alamos Report No. LA-8862-MS (09/1981).

This report outlines the use of saturable inductors as switches in lumped-element, magnetic-pulse compression circuits. The operation of the three basic types of magnetic pulse compression circuits is discussed and the characteristic use of each is defined. In addition, the geometric constraints and magnetic pulse compression circuits used in short-pulse, low-inductance systems are considered. The scaling of presaturation leakage currents, magnetic energy losses, and switching times with geometrical and material parameters are developed to aid in evaluating magnetic pulse compression systems in a particular application. Finally, a scheme for increasing the coupling coefficient in the saturable inductor core is proposed to enable their use in the short-pulse, high-voltage regime. 8 Refs.

Primary Keywords: Pulse Compression; Saturable Inductors; Lumped

Elements; Switching Characteristics; Design

Considerations

8085
(ELECTROMAGNETIC LAUNCHERS)

(Railguns)

RESULTS OF RAILGUN EXPERIMENTS POWERED BY MAGNETIC FLUX COMPRESSION GENERATORS
R.S. Hawke (1), A.L. Brooks (1), F.J. Deadrick (1), J.K. Scudder (1),
(1) M.I.T. Lincoln (2), R.C. Laird (2) and D.R. Peterson (2)

(1) Lincoln Laboratory, Lexington, MA 02430

(2) Los Alamos National Lab., Los Alamos, NM 87545

UCRL Report No. UCRL-84875 (10/1980).

Availability: UCRL-84875
NTIS

Researchers from LLNL and LANL initiated a joint railgun research and development program to explore the potential of electromagnetic railguns to accelerate projectiles to hypervelocities. The effort was intended to 1) determine experimentally the limits of railgun operation, 2) verify calculations of railgun performance, and 3) establish a data base at megampere currents. The program has led to 1) the selection of a particular magnetic flux compression generator (MFCG) design for a set of initial experiments and 2) the design of standard large square bore railguns to match the expected MFCG power profile. The bore sizes are 12.7 and 50 mm respectively. In this paper we briefly describe the design of the railguns and the diagnostic and data reduction techniques, followed by the results of eight experiments with the two railgun types. 8 Refs.

Primary Keywords: Theory; Experiment; Numerical Calculation; Flux

Compression Generator; Railgun Design Consideration

8087
(BREAKDOWN STUDIES)
(Gas, Electrical)

SURGE VOLTAGE BREAKDOWN OF AIR IN A NONUNIFORM FIELD
J.H. Park and H.H. Cones
Journal of Research of The National Bureau of Standards, Vol. 56, No. 4, pp 201-224 (04/1956).

The discharge and breakdown phenomena in air when a surge voltage is applied to spherical and plane electrodes were investigated. A stepped rise waveform of 145 kilivolts peak voltage was applied to the plane placed 56 centimeters above the laboratory floor. A 1.6 centimeter diameter sphere, mounted an adjustable distance below the plane, was connected to ground through the surge impedance of a coaxial cable. Experimental data consisted of oscillograms of the current to the sphere and pictures of the discharge between the electrodes. A method for chopping the applied voltage surge at an accurately controllable time was used to study the discharge at gap spacings for which a full-wave applied surge would cause breakdown. 17 Refs.

Primary Keywords: Pulsed Voltage; Spherical-Plane Electrodes; Variable Gap Spacing; Variable Pressure; Current Waveform

8088
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Gas, Optical; Gas, Optical)

OPTICALLY-INITIATED DIRECTED ELECTRIC BREAKDOWN IN A GAS
A.G. Akimov, L.A. Rivlin and V.S. Shil'dyav
Soviet Physics JEPP Letters, Vol. 8, No. 8, pp 258-259 (10/1968).

Trans. From: ZHETF Pis'ma V Redaktsiiyu 8, 617-619 (October 1968).

The advance in generation of intense coherent ultraviolet radiation uncover a possibility of observing plasma traces of an ultraviolet beam in a gas and various associated electric phenomena. These include in first order a directional electric breakdown along a prolonged ionized channel (plasma column), and also reflection of radio waves from the column or their propagation along the column. It is known that analogous phenomena are observed in optical breakdown of a gas by laser radiation in the infrared or visible band at high optical energy density (approximately 1E5 MW/sq.cm.). An increase of the light frequency (up to the ultraviolet), which increases the photoionization probability, should lead to an appreciable lowering of the necessary energy density and to a possibility of experimentally separating these phenomena from optical breakdown. 8 Refs.

Primary Keywords: Ultraviolet Radiation; Optically Directed; Breakdown; Low Power Density; Theory

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8089
(BREAKDOWN STUDIES)

(Gas, Electrical)

THE REIGNITION VOLTAGE CHARACTERISTICS OF FREELY RECOVERING ARCS
F.W. Crawford (1) and H. Edels (2)

(1) College Of Advanced Technology, Birmingham

(2) University of Liverpool, Liverpool, UK

Paper No. 3135 5 (04/1966).

The recovery characteristics of an arc are studied in this paper. The author compares pulsed discharges in air, nitrogen, argon and hydrogen with carbon electrodes. Current is interrupted by external means, and a second pulse of variable voltage and delay is applied. In this way, the reignition voltage of the arc can be determined as a function of time. Currents considered are from 10-50 A with pressures between 100-750 Torr and gap distances of 1.5 mm. Full gap recovery is seen to require a current interruption of about 1 sec. The process is found to closely follow the extended Paschen law. 16 Refs.

Primary Keywords: Arc Recovery Time; Restrike Voltage; Temporal Resolution; Recovery Pause Horizontal Arc; Vertical Arc

COPYRIGHT: 1960 IEE

8090
(ELECTROMAGNETIC LAUNCHERS)

(Railguns)

RAILGUN ACCELERATORS FOR GRAM-SIZED PROJECTILES

R.S. Hawke
Lawrence Livermore Lab., Livermore, CA 94550

UCRL Report No. UCRL-84623 (10/1980).

Availability: UCRL-84623
NTIS

In this paper, we describe the operation and critical parameters of railguns, we compare the potential and actual performance with other types of microparticle accelerators, and we discuss their research and industrial applications. Railgun accelerators have the potential to accelerate massive projectiles to very high velocities in very short distances. Recent research has demonstrated the feasibility of launching projectiles from railguns in industrial applications. The railgun accelerator is essentially a linear DC motor consisting of a pair of rigid parallel conductors that carry current to and from an interconnecting moveable conductor. The connecting link functions as an armature, and the parallel rails serve as a single-turn field winding. The resulting Lorentz force on the armature is proportional to the square of the current. A 1-MA current will produce about 2E5 N of thrust. A one-gram projectile will experience an acceleration of 2E8 m/s/sup 2 and in one meter achieve a velocity of 20 km/s. Conventional projectile launchers are limited to launch velocities of the order of 10 km/s. Hence railguns will enable research and applications at previously unattainable velocities. Velocities in excess of 10 km/s will lead to new research at high pressure and high-energy density. Behavior of matter in the 1-10 TPa or perhaps 100 TPa range will provide valuable insight to terrestrial and extraterrestrial phenomena. 16 Refs.

Primary Keywords: Small Projectiles; Operating Parameters; Tutorial Overview

8091
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Electrical; Gas, Optical)

CW GAS BREAKDOWN IN ARGON USING 10.6-MICRON LASER RADIATION

D.L. Frezon
National Bureau of Standards, Boulder, CO 80302

Applied Physics Letters, Vol. 21, No. 2, pp 62-64 (07/1972).

A very intense gas breakdown spark has been extended to a continuous arc in argon using a focused cw CO₂/sub 2/ laser. To achieve cw breakdown, the focal volume of a mirror focusing a high-power CO₂/sub 2/ laser was preionized by a single pulse from a CO₂/sub 2/ TEA laser. The electron density created by the pulsed laser is sufficient to start the cw plasma. This letter reports accurate measurements of pulsed thresholds as well as preionized cw thresholds for breakdown in argon. Also, a study of the time development of the cw plasma is presented. 5 Refs.

Primary Keywords: CO₂/sub 2/ Laser; Argon Gas; Laser Sustained Discharge; Ionizing Threshold; Sustaining Threshold

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8092
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Gas, Optical)

EFFECTS OF CW POWER ON THE PULSED GAS BREAKDOWN THRESHOLD IN ARGON AT 10.6-MICRON RADIATION

C.D. Moody

Army Missile Command, Redstone Arsenal, AL 35809

Applied Physics Letters, Vol. 22, No. 1, pp 31-32 (01/1973).

When the focussed beams of a pulsed CO₂/sub 2/ laser and a cw CO₂/sub 2/ laser were superimposed, the pulsed gas breakdown threshold was raised. It was found that the increase in the threshold was dependent on the gas pressure and cw power. When the intensities obtained with different focal diameters were compared, it was found that the the cw gas breakdown threshold has a 1/ \sqrt{D} dependence on the radius of the focussed cw power spot. 3 Refs.

Primary Keywords: CO₂/sub 2/ Laser; Argon (gas); CW Laser; Pulsed Laser; Superposition of Beams

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8093
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Electrical; Gas, Optical)

SIMILARITY BETWEEN PHYSICAL PROCESSES IN A PULSED DISCHARGE AND IN THE EFFECT OF LASER RADIATION ON A METAL

L.I. Grachikhin and I.Ya. Vin'ko
Institute of Physical Sciences of the BSSR, Minsk
Soviet Institute of Scientific Physics, Vol. 12, No. 5, pp 846-849 (12/1967).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1169-1172 (June 1967)

High-current pulsed discharge and concentrated laser radiation on a metal both provide strong heat sources which are comparable in magnitude (approximately 1E4-1E8 W/cm²) and which erode the surface of a metal. In this connection it is of interest to consider general physical processes taking place on the surface of a metal and in the resulting plasmas and to use this as a basis to explain some specific properties of each source. Detailed studies were made of the physical processes associated with the disintegrating effect of concentrated laser radiation on a metal. Experiments were performed using a neodymium laser which provided an energy density of 1E4-1E8 W/cm²; this is equivalent to densities realized in high-current pulsed discharges. 11 Refs.

Primary Keywords: Laser Erosion Of Metal; Pulsed Electrical Discharge; Plasma Jet; Light Emission Measurement; Dark Space

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8095
(SWITCHES, CLOSING)
(LASS)

HIGH-POWER SWITCHING WITH PICOSECOND PRECISION

G. Mourou and M. Knox
University of Rochester, Rochester, NY 14623

Applied Physics Letters, Vol. 35, No. 7, pp 492-495 (10/1979).

Up to 10 kV have been switched with Si and GaAs laser-activated switches. We show that in spite of the thermal instability shortcoming experienced in Si, quasi-DC bias operation can be utilized in a manner which relaxes stringent synchronization requirements. In the case of GaAs the thermal instability is less severe and up to 8 kV DC has been held off and efficiently switched. In both cases, fast switching time of approximately 40 ps is observed. This time is the combination of the laser pulse width, geometry bandwidth, and jitter time. Efficient switching action requires only a few tens of microjoules of laser energy. Electrical pulses ranging from subnanosecond to hundreds of nanoseconds duration have been readily generated. 6 Refs.

Primary Keywords: Silicon Switch; Light Activated; Thermal Instability; Quasi-DC Bias; 40 ps Switching Time

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8098
(SWITCHES, CLOSING; POWER CONDITIONING)
(LASS; Systems)

PICOSECOND OPTOELECTRONIC SWITCHING AND GATING IN SILICON

D.H. Austin

Bell Labs, Murray Hill, NJ 07974

Applied Physics Letters, Vol. 26, No. 5, pp 191-193 (02/1975).

Quasimetallic photoconductivity produced by the absorption of picosecond optical pulses in silicon transmission line structures has been used to devise electronic switches and gates which can be turned on and off in a few picoseconds. Electrical signals as large as 100 V can be switched by a few microjoules of optical energy. The switching speed was measured by correlating the response of two transmission gates in tandem, each having an aperture time of 15 psec. 5 Refs.

Primary Keywords: Photoconductivity; Double Pulse; 0.53 Micron Light; Ionization; Start Switch; Crowbar Switch

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8099
(BREAKDOWN STUDIES)
(Gas, Electrical)

PROGRESSIVE LIGHTNING. IV-THE DISCHARGE MECHANISM

B.F.J. Schumard

University of The Witwatersrand

Royal Society of London Proceedings, Vol. A164, No. A916-7, pp 132-150 (01/1938).

The authors present a model of the lightning process based on extensive experimental observation. The paper begins with a short review of the general discharge process. The leader process is then described in detail followed by a description of the mechanisms involved in the main stroke. Multiple strokes are also considered. 22 Refs.

Primary Keywords: Lightning; General Survey; Modeling; Leader; Pilot Streamer; Stepped Leader; Current; Luminosity; Main Stroke

COPYRIGHT: 1938 CAMBRIDGE UNIVERSITY PRESS

8100
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE POSSIBILITY OF PHOTODETACHMENT IN THE IMPULSE BREAKDOWN OF POSITIVE POINT-PLANE GAPS IN AIR

F.D.A. Bayllett and B.G. Williams

Central Electricity Research Labs, Leatherhead, Surrey, UK

British Journal of Applied Physics, Vol. 18, pp 553-559 (05/1967).

The relative importance of the roles of photodetachment and photoionization in the propagation of positive point-plane impulse corona in air is discussed. Consideration of the magnitudes of the cross sections for the two mechanisms as a function of photon energy reveals a higher efficiency for the photodetachment process. Further support for the conclusion that photodetachment is more probable than photoionization, in the circumstances considered, is drawn from experimental evidence such as the visual form of the corona and its dependence upon meteorological conditions. 5 Refs.

Primary Keywords: Point-plane Gap; Air Gap; Photoionization; Photodetachment; Corona Propagation; Cross Section; Theory

COPYRIGHT: 1967 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8103
(DIAGNOSTICS AND INSTRUMENTATION)

(Current)

WIDE FREQUENCY RANGE CURRENT TRANSFORMERS

J.M. Anderson

General Electric Co, Schenectady, NY 12301

The Review Of Scientific Instruments, Vol. 42, No. 7, pp 915-926 (07/1971).

Current transformers with resistive loads are examined experimentally to determine some of the limitations to high frequency response. Coil resonances are avoided by placement of damping resistors around the secondary winding. This permits a relatively large number of secondary turns (50 or 100), improving low-frequency response and increasing the $\omega \times L$ product even for the highest frequency transformers. Uniform response to several gigahertz is obtained in a transformer with 6.3 mm window while a range approximately 1 MHz to approximately 300 MHz is found in a larger transformer (12.7 cm diam. and 2.5 cm window). Both ferrite and iron alloy cores are utilized. 8 Refs.

Primary Keywords: Current Transformer; Wide Bandwidth; Resistive Load; Damping Resistor; Frequency Response Measurement

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8104
(ENERGY STORAGE, MECHANICAL)

(Rotating Machines)

TESTS ON THE CANBERRA HOMOPOLAR GENERATOR ARRANGED TO SUPPLY THE 5 MEGAWATT MAGNET

E.K. Inail

Australian National University, Canberra, Australia

Journal Of Physics D: Applied Physics, pp 1-9 (02/1965).

The design and testing of the Canberra Homopolar Generator are discussed. The temporal histories of the temperatures of several components are presented for high (1 MA) and low (25 kA) current discharges. The dependence of performance on brush pressure is studied. 2 Refs.

Primary Keywords: Homopolar Generator; Brush Temperature Study; Brush Pressure Study; High Current Discharge; Low Current Discharge

COPYRIGHT: 1965 INSTITUTE OF PHYSICS

8105
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas, Electrical; Surface Flashover)

CONFIGURATIONS AND MODES OF AN H-PRESSED DISCHARGE

L.D. Gorshkov, A.I. Pavlovskii, I.V. Podmoshenskii and V.A. Savchenko
High Temperature, Vol. 9, No. 4, pp 762-764 (08/1971).

Trans. From: Toplofizika Uysokikh Temperatur 9, 844-846 (July-August 1971)

The H-pressed discharge is a process in which a gas discharge is pressed against a dielectric by a magnetic field. The authors analyze the ring, coaxial, and annular H-pressed discharge. Instabilities are discussed, as are the effects of wall vaporization. The radiation of the H-pressed discharge is found to agree well with that of an absolute black body. 3 Refs.

Primary Keywords: Gas Discharge; H-pressed Discharge; Magnetic Field; Dielectric Trough; Stability Considerations

COPYRIGHT: 1972 PLenum Press, REPRINTED WITH PERMISSION

8106
(BREAKDOWN STUDIES)

(Gas, Optical)

RESONANCE EFFECTS IN MULTIPHOTON IONIZATION OF ATOMS

G. Mainfray and C. Manus

CEA Centre d'Etudes Nucleaires, Saclay, France 92260

Applied Optics, Vol. 19, No. 23, pp 3934-3940 (12/1980).

The resonance effects in multiphoton ionization over a moderate laser intensity as observed in experiments is compared with a close agreement found to the effects predicted by theory. The observed resonance effects in a high intensity range cannot be easily understood, and the authors give a qualitative explanation using the characteristic ionization time in the vicinity of the resonance. 23 Refs.

Primary Keywords: Multiphoton Effect; Experiment; Theory; Good Agreement; Polarization Effects

COPYRIGHT: 1980 OPTICAL SOCIETY OF AMERICA

8108
(PARTICLE BEAMS, ELECTRON)

(Target Interactions)

HIGH-POWER ELECTRON BEAM PREIONIZED CO/SUB 2/ CW LASER MODELLING I: DESCRIPTION OF THE INVESTIGATED DEVICE AND NUMERICAL CALCULATIONS ON E-BEAM IONIZATION

S. Martelliucci, J. Quarteri, M. Marchesini and S. Solimeno

Nuovo Cimento, Vol. 56, No. 1, pp 99-117 (11/1979).

Part I of the paper devoted to modelling high-power CW lasers gives a brief description of the investigated device and uses an analytical approximation to Bethe's formula to calculate the following quantities: the space profiles in the discharge chamber of the electron beam energy, the stopping power and the source term under operating conditions for four-component mixtures of practical interest. The energy loss of the primary beam in travelling through a thin Al foil is calculated. Parts II and III will be published promptly. Part II will be devoted to the plasma characteristics in the discharge chamber and to the kinetic and fluid-dynamic model of the laser. Part III will be devoted to an assessment of the numerical results obtained from the model and their comparison with experimental data. 20 Refs.

Primary Keywords: Energy Deposition; Gas Dynamics; Modeling; Analytical Solution

Secondary Keywords: Gas Laser; Pumping

COPYRIGHT: 1979 SOCIETA ITALIANA DI FISICA

8109
(BREAKDOWN STUDIES)
(Lightning)

SIMULATION OF LIGHTNING CURRENTS IN RELATION TO MEASURED PARAMETERS OF NATURAL LIGHTNING

J. Phillipott

Culham Lab, Abingdon, Oxfordshire, UK

1975 Conference On Lighting And Static Electricity, pp 1-13 (04/1975).
The authors begin this paper with a short discourse on the characteristics of natural lightning. Intracloud discharge and both positive and negative ground discharges are discussed with emphasis on stroke duration and peak current. The effects of these lightning strokes on aircraft are then discussed with a proposed new airworthiness requirement included. Lastly, requirements for effective lightning simulation are discussed. 30 Refs.

Primary Keywords: Lightning Characteristics; Intracloud Discharge; Ground Discharge; Effects On Aircraft; Airworthiness Specification; Simulation

COPYRIGHT: 1975 ROYAL AERONAUTICAL SOCIETY

8110
(BREAKDOWN STUDIES)
(Gas, Electrical)

FORMATION OF A POSITIVE BURST PULSE CORONA IN AIR, NITROGEN AND OXYGEN

T. Takara

Shizuoka University, Hamamatsu, Japan

Journal Of The Physical Society Of Japan, Vol. 17, No. 9, pp 1434-1439 (09/1952).

The author utilizes Loeb's condition to derive an analytical solution for the onset of positive pulse burst pulse corona in a point-point gap. Avalanche and photo-ionization are included to obtain formulas to predict the onset of burst pulse corona and to estimate the effective absorption coefficient for the radiation produced. 16 Refs.

Primary Keywords: Loeb's Condition; Point-point Electrodes; Ionizing Photons; Absorption Coefficients; Experiment; Theory

8111
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

THE EXPLODING WIRE PHENOMENON

C.A. Privette

Jet Propulsion Lab, Pasadena, CA

JPL Technical Report No. 33-113 (01/1963).

Availability: H62-19203

NASA

A brief outline of the exploding wire phenomenon together with a description of some techniques employed in measuring various parameters of the explosion process is presented. Two copper wires, 1 and 3 mils in diameter, were exploded, utilizing a 16,000-J capacitor bank. These explosions are used as models for various theoretical descriptions concerning temperature and current histories. Results of these theoretical treatments predict maximum temperatures of approximately 100,000 amp., 12 Refs.

Primary Keywords: Experiment; Theory; Simulation; Numerical Calculation; Copper Wire; Measurement Technique

8112
(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

THEORETICAL ANALYSIS OF THE HYDRODYNAMIC FLOW IN EXPLODING WIRE PHENOMENA

C.A. Rose

Lawrence Livermore Lab, Livermore, CA 94550

UCRL Report No. UCRL-5519-T (03/1959).

Availability: UCRL-5519-T

NTIS

Theoretical calculations of exploding wire phenomena have been carried out with an IBM 704 Lagrangian code. The model for this analysis assumes instantaneous energy deposition in the wire. Calculations were made with different conditions. Among those presented are (1) different effective equations of state for the copper wire and (2) different equations of state for the surrounding air. The equations of state for the air are (a) a constant gamma-law gas and (b) the variable gamma-law gas calculated by F.R. Gilmore. The shock wave propagation in each is shown to require significantly different energies. The results are compared to calculations made without copper wire energy assumed deposited in the volume of air equal to that of the wire, and with a similar similarly solution for cylindrical shock waves. The propagation of the shock wave in air calculated with the Gilmore equation of state for air shows excellent agreement with that observed by F.D. Bennett. The second shock wave in the copper shows qualitative agreement with that observed by Bennett, but indicates that in the range of EWP, copper does not act like a constant gamma-law gas. As for similarity, it is shown that hydrodynamic flow during the explosion of wires is not similar. 7 Refs.

Primary Keywords: Exploding Wire; Copper Wire; Numerical Calculation; Shock Wave; Double Shock

8113
(INSULATION, MATERIAL; PULSE GENERATORS)
(Liquid, Systems)

DIELECTRICS STUDY FINAL REPORT

G.K. Simcox

Energy Sciences Inc., Burlington, MA 01803

DNA Report No. DNA2823F (06/1972).

Availability: AD 743170

NTIS

This reports the findings of an experimental study to investigate the dielectric strength of deionized water when pulse stressed by a 'double resonance' transformer. The data provide evidence that the prestress conditions do not significantly affect the results. Additionally, it is suggested that the relationship for maximum stress as a function of time and electrode area can be applied for stress times of 5-10 microseconds. The transformer generator is discussed in some detail. The conclusion is drawn that this generator form would be a sensible choice in a pulse system using pressurized water dielectric. High dielectric strengths are now claimed for this treatment with effective stress times of tens of microseconds, a range which is compatible with the transformer pulse signature. 2 Refs.

Primary Keywords: Dielectric; Deionized Water; 'Double Resonance' Transformer; Prestress; Waveshape Dependence

8114
(PARTICLE BEAMS, ELECTRON; PARTICLE BEAMS, ELECTRON)
(Target Interaction; Generation)

PRODUCTION OF DENSE THERMIONUCLEAR PLASMAS BY INTENSE RELATIVISTIC ELECTRON BEAMS

F. Minterberg

University of Nevada System, Las Vegas, NV 89109

Proceedings Of The International School Of Physics 'Enrico Fermi'
Course: XLVIII (07/1969).

The author discusses various aspects of thermonuclear fusion. The necessary characteristics of the target and the relativistic electron beam which it is to be bombarded with are discussed. Generation of the electron beam and its interaction with the target are also examined. Conversion of the nuclear reaction into useful power, and the application of the process as a rocket propulsion system are considered. A method for producing an intense ion beam is briefly presented. 17 Refs.

Primary Keywords: Target Interaction; Collective Effects;
Superconducting Ring Generator

Secondary Keywords: E-beam Fusion

COPYRIGHT: 1971 SOCIETA ITALIANA DI FISICA

8115
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

100-KHZ QUENCHING SPARKGAPS HAVE $1E12$ A/S CURRENT RISE

W.E. Austin

General Electric Co, Valley Forge, PA

Laser Focus, Vol. 11, No. 6, pp 79-80 (06/1975).

A sparkgap using perforated quenching electrodes is presented. The sparkgap will allow a rise of $1E12$ A/sec with repetition rates up to 100 kHz at an energy of 0.22 joules per pulse. A schematic of a high repetition rate pulseforming network using the sparkgap is given. 1 Refs.

Primary Keywords: Quenching Spark Gap; Quenching Screen; Fast Current Pulse; Rep-rate; High Frequency; Low Energy Per Pulse

COPYRIGHT: 1975 ADVANCED TECHNOLOGY PUBLICATIONS, INC.

8116
(PULSE GENERATORS)

(Trigger)

A MAGNETIC-THYRISTOR GENERATOR PRODUCING HIGH-VOLTAGE NANOSECOND PULSES

A.N. Vorob'ev, V.M. Bogdanov, F.L. Gercikov, V.G. Guk and A.A. Ushakov

Instruments And Experimental Techniques, Vol. 17, No. 1, pp 110-111 (02/1974).

Trans. From: Priroby i Tekhnika Eksperimenta 1, 103-104 (January-February 1974).

A compact generator which produces powerful nanosecond pulses is described. The length of the pulses across the load of 200 to 300 ohm is 9 to 12 nsec for a duration of the leading edge equal to 4 to 5 nsec. The repetition frequency of the pulses is up to 1.0 kHz; the power in the pulse is <25 kW; the amplitude of the pulse is <=2.5 kV. The generator weight is 120 g. 2 Refs.

Primary Keywords: Pulse Generator; Rep-rate; 2.5 KV Output; 1 kHz Repetition Rate; Light Weight; Thyristor; Ferrite Peaking Line

COPYRIGHT: 1974 PLenum Press, REPRINTED WITH PERMISSION

8117
(SWITCHES, CLOSING; SWITCHES, CLOSING)

(Systems; LASER)

A LIGHT-CONTROLLED, HIGH-POWER PULSE SHAPER

V.G. Glotov and G.G. Kobylevskii

Soviet Journal Of Optical Technology, Vol. 39, No. 9, pp 578-579 (09/1972).

The authors present a design for a system which shapes pulses that can then turn on a high power thyristor. The system has a high noise immunity, and the frequencies it can handle depend primarily on the time constant of the photodiector. 0 Refs.

Primary Keywords: Radiation Detector; Pulse Amplifier; Thyristor Trigger

COPYRIGHT: 1972 OPTICAL SOCIETY OF AMERICA

8118
(BREAKDOWN STUDIES)

(Gas, Electrical)

ARC MOTION DRIVEN BY MAGNETIC FIELD IN SULFUR HEXAFLUORIDE (SF₆)

(i) Suzuki (1) and H. Dimachi (2)

(ii) Toshiba Research and Development Center, Uchishima-cho, Kawasaki-ku, Kawasaki

(2) Toshiba High Power Lab, Uchishima-cho, Kawasaki-ku, Kawasaki

Japan, J. J. Jurnal, Cf Applied Physics, Vol. 14, No. 4, pp 487-493 (04/1975).

A magnetic field set up transverse to the field line was used to drive arcs in sulfur hexafluoride and in air. The arc motions were photographed using a high speed camera, and the arc speed was found to be faster in air than in sulfur hexafluoride. The arc moved relatively smoothly when copper electrodes were used, but arc spots could not be driven in the first stage when brass electrodes in sulfur hexafluoride were used. 10 Refs.

Primary Keywords: Magnetic Field Driven Arc Motion; Various Gases; Lightning Arresters; Copper Electrode; Brass Electrode

COPYRIGHT: 1975 PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

8119
(POWER CONDITIONING)

(Pulse Transformers)

EFFECT OF CORE CHARACTERISTICS ON PULSE-SHAPE DISTORTION BY A PULSE TRANSFORMER

S.O. Udrovin

Radiotekhnika And Communications Systems, Vol. 22, No. 3, pp 96-97 (07/1977).

Trans. From: Izvestiya VUZ, Radiofizika 22, 87-88 (1979).

Expressions are derived which relate the shape of the core to the pulse-shape distortion. The effect of the shape of the cross section of the core on the core volume, the rise time of the pulse, and the voltage drop of the transformed pulse is discussed. 1 Refs.

Primary Keywords: Core Characteristics; Minimum Volume; Short Rise Time; Design Considerations

COPYRIGHT: 1980 ALLERTON PRESS, INC.

8120
(POWER CONDITIONING; POWER CONDITIONING)
(Pulse Transformers; Linear Inductors)
FERRITES FOR LINEAR APPLICATIONS II-PERFORMANCE REQUIREMENTS
E.C. Snelling
Mullard Research Labs
IEEE Spectrum, Vol. 9, No. 2, pp 26-32 (02/1972).
The final installment of this article focuses on the applications employing ferrites, including inductors for FDM filters, wide-band and pulse transformers, and high-frequency power transformers. In the typical modern television receiver, a total of about 0.6 Kg of ferrite cores is used in a variety of applications, such as line output transformers, deflection yokes, and convergence systems. 14 Refs.
Primary Keywords: Soft Ferrite; Pulse Transformer; Inductor; Design Considerations; Losses
COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

8122
(ENERGY STORAGE, INDUCTIVE)
(Systems)
A PROPOSAL FOR THE CONSTRUCTION AND OPERATION OF AN INDUCTIVE STORE FOR 20 MEGAJOULES
E.K. Inall
Culham Lab, Abingdon, Oxfordshire, UK
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 679-685 (07/1972).
A proposal for coupling 20 MJ of energy initially stored in the Canberra homopolar generator, to a load in about 1.0 ms is described. The energy is first transferred to a coaxial inductor at a peak current and voltage of 1.5 MA and 190 V respectively. The opening of a fast mechanical switch which is being developed transfers the energy from the inductor to the load, producing a voltage of 1000 V across the latter. The system is intended for use with high energy lasers. 10 Refs.
Primary Keywords: Homopolar Generator; Coaxial Inductor; Mechanical Switch; Low Voltage; High Current
Secondary Keywords: Flash Lamp Driver
COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8123
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
KILOVOLTmeter MEASURES AC AND DC WITH OVER 1E16-DHM INPUT RESISTANCE
R.J. Gardner
University of Alberta, Edmonton, Alberta, Canada
Electronic Design, Vol. 27, No. 20, pp 90 (09/1979).
The circuit presented measures high AC or DC voltages under true no-load conditions. It is expected to be used instead of the conventional resistive divider which eliminates loading problems and simplifies differential measurement. 0 Refs.
Primary Keywords: Capacitive Voltage Divider; High Input Impedance; High Stability; DC Measurement Capability
COPYRIGHT: 1979 HAYDEN PUBLISHING COMPANY, INC.

8124
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps; Optical; Gas, Optical)
NANOSECOND TRIGGERING OF AIR GAPS WITH INTENSE ULTRAVIOLET LIGHT
T.F. Godlove
Naval Research Lab, Washington, DC 20375
Journal Of Applied Physics, Vol. 32, No. 5, pp 1589-1596 (08/1961).
Measurements are presented of the breakdown time of a conventional two-electrode air gap. The applied voltage is maintained below the sparking threshold and breakdown is caused by the emission of a 6-nanosecond burst of photoelectrons from the cathode, which produces space-charge distortion of the electric field. An auxiliary trigger spark provides the necessary light and results in cathode emission up to approximately 10 mA/cm². The dominant wavelength region is found to be approximately 1100 Å because of the relatively low air absorption and high photoelectric yield in this region. For a fixed gap spacing and using the highest light intensity available, the time delay is typically found to decrease from approximately 5_{1/2} to a minimum delay of 82_{1/2} ns as the main gap voltage is increased from approximately 82% below threshold up to threshold. The minimum delay remains from 10_{1/2} to 15_{1/2} ns above threshold for the gap spacings studied and agrees with calculated values. Gap spacing is an important factor. The techniques developed have direct application to the triggering of conventional spark-gap switches and to pulsed light sources and may provide an additional tool for investigating some of the basic parameters of gaseous electronics. 15 Refs.
Primary Keywords: Cathode Effects; Photoemission; Space Charge, Analysis; Overvoltage
COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8125
(DIAGNOSTICS AND INSTRUMENTATION; DIAGNOSTICS AND INSTRUMENTATION)
(Current; Voltage)
OPTICAL METHODS FOR MEASUREMENT OF VOLTAGE AND CURRENT ON POWER SYSTEMS
A.J. Rogers
Central Electricity Research Labs, Leatherhead, Surrey, UK
Optics And Laser Technology, Vol. 9, No. 6, pp 273-283 (12/1977).
Methods of optically measuring voltage and current in high voltage systems are examined. The magnetooptic effect, the electro-optic effect, the piezooptical effect, and the electrogravitation effect are discussed. Free and enclosed path systems are considered along with the necessary detection and noise reduction techniques. 12 Refs.
Primary Keywords: Basic Principles; Electro-optic Effect; Magnetooptic Effect; Electrogravitation Effect; Noise Reduction
COPYRIGHT: 1977 IPC BUSINESS PRESS LIMITED

8126
(PARTICLE BEAMS, ION)
(Generation)
SERII: DESIGN REQUIREMENTS FOR INTEGRATING ELECTRIC PROPULSION INTO A SPACECRAFT
R.J. Rulis
Lewis Research Center, Cleveland, OH
Journal Of Spacecraft And Rockets, Vol. 8, No. 3, pp 209-213 (03/1971).
Design requirements for SERII (Space Electric Rocket Test), and the way they were implemented are presented. Discussed are mechanical thermal design considerations, electrical requirements, high-voltage handling methods, and thruster-power conditioner system requirements. Methods for testing the system just before launch are considered. 7 Refs.
Primary Keywords: Ion Thruster; Performance Test; Power Transmission
Secondary Keywords: Thermal Design; Mechanical Design
COPYRIGHT: 1971 AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, INC.

8127
(POWER CONDITIONING)
(Transient Suppressors)
SIX WAYS TO CONTROL TRANSIENTS: VARISTOR, GAS-DISCHARGE AND RC SUPPRESSORS PROTECT CIRCUITS FROM DESTRUCTIVE SURGES
R.W. Fox
General Electric Co, Syracuse, NY 13201
Electronic Design, Vol. 11, pp 52-57 (05/1974).
Six different types of suppressors are given as possible devices for protecting circuits from high-voltage transients. Zener diodes, selenium devices, metal-oxide devices, silicon-carbide devices, gas-discharge (spark gap) devices, and resistor-capacitor networks are discussed. The devices are compared using their peak idle current, maximum current, peak power, effective clamping ratio, voltage range, and cost. 0 Refs.
Primary Keywords: Zener Diode; Selenium Rectifier; Metal-oxide Device; Silicon-carbide Device; Spark Gap; RC Network;
Design Considerations
COPYRIGHT: 1974 HAYDEN PUBLISHING CO., INC.

8128
(PARTICLE BEAMS, ION)
(Generation)
COMPUTATIONAL STUDY OF MAGNETIC DAM EFFECTS IN A HIGH IMPEDANCE DIODE
R.J. Barker, S.A. Goldstein and A.T. Drobot
Naval Research Lab, Washington, DC 20375
NRL Report No. 6462 (10/1981).
Availability: AD A136154
NTIS
Computer simulations have been conducted to test the 'magnetic dam' concept as a means for boosting the overall ion efficiency of high impedance diodes. The 'dam' consists of a cell located immediately behind the anode foil containing a wire along its central axis which carries a current flowing in a direction opposite to that in the diode gap. The azimuthal magnetic field generated by the wire current, $I_{\text{sub}} w$, reflects the electrons crossing the foil back into the A-K gap at higher radii, where their space charge can enhance ion emission over relatively large areas. Significant increases in the ion current result, and for several values of $I_{\text{sub}} w$ but a simultaneous increase in electron current prevent any overall ion efficiency. Instead, only decreased impedances were observed. The cause of this phenomenon is explained and solutions which could benefit a wide range of future diode designs are presented. 7 Refs.
Primary Keywords: Magnetic Dam Diode; Numerical Calculation; Intense Ion Beam Generation; Magnetic Field Electron Reflection

8129
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
CONSTRUCTION AND EVALUATION OF A PROTOTYPE ELECTROMAGNETICALLY SHIELDED ROOM
H.A. Lenitter
Naval Civil Engineering Lab, Port Hueneme, CA
Technical Report No. R-454 (01/1966).
Availability: AD 636179
NTIS
An electromagnetically shielded room composed of 20-gage sheet-metal wall material with continuously soldered seams was constructed and evaluated at the Naval Civil Engineering Laboratory. The 10 x 20 x 8-foot room is a prototype model designed as a basis for determining specifications for the construction of large shielded room installations. Electromagnetic shielding evaluation of the room was performed in accordance with MIL STD-285, along with additional measurements at 1.0, 2.5, and 9.0 GHz. The lowest value of shielding effectiveness was 65 decibels at 14 kHz. Construction techniques for such design features as sheet-metal joints, soldered seams, power wiring, fittings, and fasteners, and cable entryways are discussed. Techniques for providing penetrations into the room for gas, water, and sewage were investigated. Measurements of the effect of small, controlled openings into the room were determined. The acoustic shielding properties of the room are also given in this report. 7 Refs.
Primary Keywords: Screen Room; Shielding Evaluation; Penetration Techniques; Line Filtering; Reliability

8130
(BREAKDOWN STUDIES)
(Gas, Electric.)
GAS BREAKDOWN CALCULATION: A COMPARATIVE STUDY
D.A. Klar
AFL, Wright-Patterson AFB, OH
GEF Report No. GEF/PW/76-7 (12/1976).
Availability: AD A034934
NTIS

An attempt is made to develop a simple yet accurate gas breakdown model which can be easily coupled to the hydrodynamic equations governing fluid flow in laser-target interactions. The accuracy of three relatively simple models is investigated. Each is compared with the more accurate and complex quantum kinetic model, to determine the conditions under which it maintains reasonable accuracy. A gas consisting of a single monatomic species is assumed and attention is restricted to the early portion of the electron cascade. A temperature model is found to agree reasonably well with the quantum kinetic model at values of incident laser flux greater than 5E9 W/cm². A diffusion model is found to yield similar results. A two-temperature model, which is derived in an attempt to extend the range of the temperature model to lower values of incident flux, is found to be invalid. 15 Refs.
Primary Keywords: Optical Breakdown; Air Breakdown; Threshold; Breakdown Modeling; Temperature Model; Two Temperature Model

8131
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)
GUIDE FOR SHIELDED ENCLOSURE CONSTRUCTION PROBLEMS
Authors Unknown
Naval Civil Engineering Lab, Port Hueneme, CA
N Report No. N-877 (03/1967).
Availability: AD A81828
NTIS
This report touches on the important aspects of shielded room design. Shielding materials, door seals, and seams are discussed with recommendations given. Particular attention to the shielding and power line filtering are shown to be important considerations needing attention from the outset. Long term reliability is addressed with typical problem areas identified and repair procedures presented. Test procedures are included. 8 Refs.
Primary Keywords: Shielded Room; Soldered Joint; Door Seal; Shielding Penetration; Line Filtering; Test Procedure

- 8132** INVESTIGATING THE LUMINESCENCE ORIGINATING DURING THE ELECTRIC FULMINATION OF THIN WIRES
M.P. Vanyukov and V.I. Isaevenko
Report No. RFD-77-62-77/1 (06/1962).
Trans. From: Zhurnal Tekhnicheskoy Fiziki 32, 197-201 (1962)
Availability: AD 286190
NTIS
- With the aid of an electron-optical scanner was investigated the development of luminescence and cloud of fulmination products originating during the fulmination of wires. Established were certain laws governing the rate of expansion of the luminous channel and cloud of fulmination products, as well as the localization of the zone of luminescence. 10 Refs.
- 8134** (BREAKDOWN STUDIES)
(Surface Flashover)
THE RELATION BETWEEN THE CHARGE TRANSPORTED AND NUMBER OF PHOTONS EMITTED IN PARTIAL DISCHARGES ON DIELECTRIC SURFACES
J.S. Brzozko, J. Grudziński, A. Korerzowski, E. Zukowski, W. Wojsiewicz, W. Zukowski and J. Kunicki
Bialystok Div., Warsaw University, Bialystok, Poland
Journal of Physics D: Applied Physics, Vol. 10, pp L155-L158 (05/1977).
Experiments are described in which two-dimensional measurements were taken of the relationship between charge transported and photons emitted during creep discharges. This relation was found to be linear. However, there is a difference for positive and negative corona. The difference is thought to be due to the different average energy of the electrons in the discharge channel. 10 Refs.
Primary Keywords: Partial Discharge; Charge Transport; Light Emission; Creep Discharge
COPYRIGHT: 1977 INSTITUTE OF PHYSICS
- 8135** (POWER CONDITIONING)
(Pulse Transformers)
MEGAMPERE PULSE TRANSFORMER FOR COAXIAL LOAD
W.H. Clark and J.E. Myberg
Utah Research and Development Co., Inc., Salt Lake City, Utah 84106
The Review of Scientific Instruments, Vol. 37, No. 7, pp 883-885 (07/1966).
A transformer is described which delivers 2 MA into a low impedance load through a coaxial output line of about 0.35 mm inner conductor diameter and 0.55 mm cavity diameter. The transformer primary is connected to a 20 microfarad, 50 kV capacitor bank by forty-eight flexible coaxial cables. The ringing frequency of the system with the secondary shorted is 70 kc. 0 Refs.
Primary Keywords: Step Down Transformer; Pulse Transformer; 2 MA Current
Secondary Keywords: Plasma Gun
COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 8136** (BREAKDOWN STUDIES)
(Gas, Electrical)
DIELECTRIC BEHAVIOR OF SOME FLUOROGASES AND THEIR MIXTURES WITH NITROGEN
G. Comilli, T.H. Lian and R.E. Plump
General Electric Co., Pittsfield, MA 01201
Electrical Engineering, Vol. 79, No. 7, pp 580-584 (07/1955).
The authors present data on several fluorogases and fluorogas-nitrogen mixtures in this paper. The breakdown voltage and corona threshold voltage for the gases and mixtures are tabulated for AC, DC, and impulse voltages as a function of gas pressure and electrode spacing. Both uniform and nonuniform fields are considered using parallel-plane and rod-plane gaps. Correlations are made between gas molecular weight and breakdown voltage. Comparisons with air and sulfurhexafluoride are shown. 15 Refs.
Primary Keywords: Fluorocarbon; Dielectric Strength; AC Voltage; DC Voltage; Impulse Voltage; Corona Test; Comparison With Sulfurhexafluoride
COPYRIGHT: 1955 AIEE
- 8137** (BREAKDOWN STUDIES)
(Gas, Electrical)
EXPANSION OF INITIAL HIGH-CURRENT SPARK CHANNELS
C.C. Gallagher and H. Fisher
AFTRL, Bedford, MA 01730
Applied Optics, Vol. 4, No. 7, pp 1151-1154 (09/1965).
The paper describes experiments in which a jetted Kerr cell, with exposure times of 2-8 nsec, is used to observe the expansion in air of spark channels. The sparks are triggered by a 50 nsec, 7 kv pulse resulting in a time jitter of less than a nanosecond. A current rise of 2612 A/sec is observed along with a maximum expansion velocity of 1.65 cm/sec. 2.6 nsec into the breakdown. 9 Refs.
Primary Keywords: Spark Channel Expansion; Several Gases; Erosion by a Cloud; Light Emission Measurement
COPYRIGHT: 1965 OPTICAL SOCIETY OF AMERICA
- 8138** (BREAKDOWN STUDIES)
(Solid, Orthogonal)
LASER-INDUCED ELECTRON EMISSION FROM SOLIDS: MANY-PHOTON PHOTOELECTRIC EFFECTS AND THERMIONIC EMISSION
E.M. Logothetis and P.L. Hartman
Cornell University, Ithaca, NY 14850
Physical Review, Vol. 187, No. 2, pp 460-474 (11/1969).
The intensity dependence and energy distribution of laser-induced electron emission are measured. The results are analysed in terms of multiphoton ionization and thermionic emission. The materials used were Au, stainless steel, CsI, KI, and KCl. Two-photon photoelectric spectroscopy was performed in CsI and KCl, and the spectrum obtained is discussed. 36 Refs.
Primary Keywords: Photoelectric Emission; Laser Induced Breakdown; Multi-photon Effects; Experiment; Theory
COPYRIGHT: 1969 AMERICAN PHYSICAL SOCIETY
- 8139** (PULSE GENERATORS; DIAGNOSTICS AND INSTRUMENTATION)
(Line Type, Voltage)
PRODUCTION AND MEASUREMENT OF ULTRA-HIGH SPEED IMPULSES
R.C. Fletcher
Massachusetts Institute of Technology, Cambridge, MA
The Review of Scientific Instruments, Vol. 20, No. 12, pp 861-869 (12/1949).
The capabilities and limitations of several impulse generators and voltage dividers, and a micro-oscillographic sweep circuit for dealing with k volt impulses in the millisecond range, are described. The most successful combination produces and measures an impulse of a rise time equal to 1E-10 sec. 4 Refs.
Primary Keywords: Transmission; Line; Pulse Generator; Three Gap Spark Gap; Voltage Divider; 20 kV Voltage; Subnanosecond Rise Time
COPYRIGHT: 1949 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 8140** (DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
STEP RESPONSE OF MEASURING SYSTEMS FOR HIGH IMPULSE VOLTAGES
F.C. Creed (1), C. New (1) and T. Kawamura (2)
(1) National Research Council, Ottawa, Ontario, Canada
(2) University of Tokyo, Institute of Industrial Science, Tokyo, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-86, No. 11, pp 1920-1920 (11/1967).
The generalized impulse voltage measuring system is analyzed as a complete entity using the step response approach. The analysis shows that the response time of the system is not determined correctly by conventional methods and a new method is presented. Revisions to the conventional methods are proposed which will enable the true response time of the system to be determined. Five separate measuring systems are investigated experimentally using both techniques and the predicted and measured values of the conventionally measured response time are shown to be in very good agreement. As a result of the investigation, certain specific suggestions are made for revisions to existing standards for this type of measurement. 6 Refs.
Primary Keywords: Calibration; Probe Characterization; Step Response; Predicted Response; Good Agreement
COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION
- 8141** (DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)
A HIGH-IMPEDANCE, NANOSECOND RISE TIME PROBE FOR MEASURING HIGH-VOLTAGE IMPULSES
G. New
National Research Council, Ottawa, Ontario, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-87, No. 9, pp 1780-1786 (09/1968).
Normal voltage dividers for high-voltage impulses are connected to the test object by an open air line which, when considered as part of the measuring system, gives an initial low-impedance to that measuring system due to the characteristic impedance of the line. This initially low impedance has been overcome by building a divider which can be used as an attenuator probe connected directly to the point on the test object at which the voltage is to be measured. By having the probe at a distance from the ground plane, the input capacitance can be kept low thus allowing the probe to have a shorter rise time. Examples of results are given. 6 Refs.
Primary Keywords: Resistive Voltage Divider; Direct Connection To Test Point; Small Input Capacitance; Analysis
COPYRIGHT: 1968 IEEE, REPRINTED WITH PERMISSION
- 8143** (DIAGNOSTICS AND INSTRUMENTATION)
(Current)
A CURRENT TRANSFORMER FOR LOW LEVEL MICROSECOND PULSES
W.J. Serapion and E. Benben
University of Western Ontario, London, Ontario, Canada
The Review of Scientific Instruments, Vol. 41, No. 5, pp 775-776 (05/1970).
This note describes the design and operating characteristics of two large-area (18 and 65 mm) current transformers. The small detector unit was constructed with a Philips K-300-500 toroidal core. A single turn of annealed wire was first wound around the periphery of the toroid and held in place by a wrapping of 3 mm wide masking tape. The 50-turn main winding was then close wound on by hand with each turn lying in the center aperture of the toroid, continuing clockwise around the core. For external magnetic fields, no hairpin winding looks like a single turn. By connecting the single turn first, it is possible to balance the toroid in series, coupling to the main winding, effectively no net flux due to external fields is coupled to the circuit. 1 Refs.
Primary Keywords: Current Transformer; Fast Rise; Sub-amperes Current
COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 8144** (DIAGNOSTICS AND INSTRUMENTATION)
(B-field)
A SUBNANOSECOND RISE TIME FLUXMETER
D.G. Pellingen
Physic International Co., San Leandro, CA 94577
The Review of Scientific Instruments, Vol. 42, No. 5, pp 667-670 (05/1971).
A self-integrating search coil with a rise time of approximately 0.4 nsec has been developed for measuring kilogauss magnetic fields in adverse environments. A coaxial calibration fixture with a field rise time of 0.85 nsec was built to calibrate the fluxmeters. 0 Refs.
Primary Keywords: Fluxmeter; Kilogauss Fields; Half-nanosecond Rise Time; Self Integrating
COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8146
(ENERGY STORAGE, INDUCTIVE)
(Systems)

ADVANCED CONCEPTS FOR PHOTON SOURCES VOLUME 2: FAST SWITCHING OF VACUUM MAGNETIC ENERGY STORES
V. Bailey, L. Demeter, J. Benford, A. Noeth and D. Sloan
Physic International Co., San Leandro, CA 94577
DHA Report No. DHA-3680F-2 (10/1973).
Availability: AD-A015386

HTS
Inductive (magnetic) energy storage systems are analyzed in terms of their application to generation of ultrahigh power pulses. Such systems can transform low-power energy inputs into high-power outputs (power multiplication) by shortening the energy delivery time. Energy transfer from magnetic store to resistive load can approach 100 percent efficiency. Models of several accelerated metallic plasma transfer switch geometries indicate that such switches can be energetically efficient and can produce substantial voltage multiplications. Using a versatile and extensively diagnosed apparatus, experiments were conducted to test these predictions. The experiments confirmed the modeling and established design criteria for metallic core and solid switches. Operating at 25 kV energy level, a coaxial switch produced net voltage (60 to 300 nsec) voltage spikes with voltage and power multiplications of 3. 8 Refs.

Primary Keywords: Magnetic Energy Stores; Fast Switching; Power Multiplication; Power Pulse Compression; Vacuum Switch; Metallic Plasma Switch

8149
(INSULATION, MATERIAL; BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Reviews; Gas, Electrical; Gas Gaps, Electrical)

HIGH VOLTAGE INSULATION OF LINES AND EQUIPMENT
M.K. Kelinina
FTD Report No. FTD-MC-23-749-71 (09/1971).
Trans. From: Leningrad Polytechnic Institute, Transactions, 258, 3-9, 61-78, 88-105, 116-117, 132-137, 161-171 (1965).
Availability: AD 734055

NTIS
This report includes nine selected papers on insulation testing, pulse generators, and switching. The first article describes a 2.2 MV pulse generator. Due to space limitations, the authors chose a stacked Marx generator. The design philosophy and testing are presented. The next five papers concern the theory and operation of spark gaps. Low power simulation of high power operation, arc quenching, parallel operation, and jitter studies are included. The last three papers are devoted to the insulation of high voltages. Breakdown of liquid and solid insulations are included. 9 Refs.

Primary Keywords: Marx Generator; Capacitor; High Power Switch; Simulation; Arc Extinction; SF₆/Gas; Dielectric Strength; Insulation Breakdown; Insulation Polarization

8151
(PULSE GENERATORS)
(Current)

CURRENT PULSE GENERATOR

G.L. Chakhlov
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 21, No. 2, pp 398-400 (04/1978).
Trans. From: Priboi i Tekhnika Eksperimenta 2, 123-125 (March-April 1978).

A new scheme for a current pulse generator with a combined 'coil-capacitance' is discussed. The operation is analyzed in terms of an equivalent circuit. The efficiency of the generator is tested on a model made from sections of a pulsed capacitor of 40 microfarads and 800 V at a frequency of 400 Hz and a maximum current of 80 A. 3 Refs.

Primary Keywords: 'Coil Capacitance'; Equivalent Circuit; Analysis; Model Test; Reprinted

COPYRIGHT: 1978 PLENUM PRESS, REPRINTED WITH PERMISSION

8153
(BREAKDOWN STUDIES)
(Gas, Electrical)

MANSECONND PULSE BREAKDOWN IN GASES

P. Feigenthal and J.M. Vlachos
Space Sciences Inc., Williamsburg, VA
Physical Review, Vol. 173, No. 6A, pp A1795-A1804 (07/1965).
The theory describing the formative period of breakdown in gases following the sudden application of a DC electric field has been developed and applied to the design of experiments to measure lag times in nine gases. It is shown analytically that under certain conditions pulsed-DC and pulsed-microwave breakdown are directly comparable. A pulsed-DC experimental system is described which permits measurements of the formative period over a wide range of applied field, gas pressure, and gas space. For those gases where sufficient basic data are available, theoretical and experimental results are in good agreement. 13 Refs.

Primary Keywords: Gas Breakdown; Nine Gases; Formative Time Lag; Step Voltage Breakdown; Microwave Breakdown; Theory; Experiment; Comparison Of Results

COPYRIGHT: 1965 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8154
(BREAKDOWN STUDIES)
(Exploding Wires)

OBSERVATION OF A CORE IN AN EXPLODED LITHIUM WIPE PLASMA BY REFLECTION OF LASER LIGHT

T.A. Leonard
University of Michigan, Ann Arbor, MI
Journal of Applied Physics, Vol. 44, No. 3, pp 1380-1381 (03/1973).
A thin lithium wire which was extruded and exploded in a vacuum was probed with a Q-switched Nd:YAG laser. Strong reflections from the ruby laser light were observed from a 'core' in the plasma when the pressure was greater than 5E-4 Torr. Changes in the plasma and discharge properties near this pressure suggested the possibility of a core of unvaporized wire due to current shunting through the surrounding air. The presence of this core was unexpected because of the relatively large discharge current and small wire diameter. When the pressure was below 5E-4 Torr, 'core' was never observed and there was no evidence of current shunting. 9 Refs.

Primary Keywords: Exploded Wire; Lithium Wire; Vacuum Environment; Ruby Laser Diagnostics; High Density Plasma 'Core'

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8155
(PARTICLE BEAMS; ELECTRON; BREAKDOWN STUDIES)
(Generation; Electrodes)

ON THE THEORY OF FIELD EMISSION FROM METALS

F.I. Itskovich
Khar'kov Military Engineering College
Soviet Physics JETP, Vol. 23, No. 5, pp 965-953 (11/1966).
Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 50, 1425-1437 (May 1966)

Field emission from a metal single crystal is investigated for an arbitrary electron dispersion law. If the Fermi surface is intersected by an axis p_z perpendicular to the emitting surface of the sample, the free-electron theory formula for the field emission current remains valid except for the pre-exponential factor. Otherwise the conservation of the tangential momentum of an electron emitted from the metal leads to the results that the work function W in the exponential must be replaced by a larger quantity W' . The distance between the Fermi surface and the p_z axis can be estimated from the difference $W - W'$, which thus yields definite information concerning the electron spectrum of the metal. 5 Refs.

Primary Keywords: Field Emission; Metal Crystal; Fermi Surface; Free Electron Theory; Electron Energy Spectrum

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8157
(BREAKDOWN STUDIES)
(Gas, Electrical)

PULSES HIGH-PRESSURE ARC IN HELIUM AND HYDROGEN

Yu R. Knyazev, F.S. Borovik, R.V. Mitin and V.I. Petrenko
Soviet Physics-Technical Physics, Vol. 12, No. 3, pp 374-380 (09/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 523-532 (March 1967)

This paper gives the results of an investigation of a pulsed high-pressure arc in helium and hydrogen at pressures up to 6E5 N/m² and currents up to 40 kA. The pulsed arc is produced by the discharge of a capacitor bank through a long, DC, high-pressure arc, or through a thin wire. The results of electrical and spectral investigations and of measurements of the visible brightness of the steady and pulsed arcs are given. Photographs of steady and pulsed arcs obtained by means of a camera obscura are also shown. 5 Refs.

Primary Keywords: Steady Arc; Pulsed Arc; High-pressure Arc; Capacitor Bank; DC Arc; Thin Wire

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8160
(BREAKDOWN STUDIES)
(Gas, Electrical)

SPARKING POTENTIALS OF SATURATED HYDROCARBON GASES

J.S. Mirza, C.W. Smith and J.H. Calderwood
University of Salford, Salford, UK
Journal of Physics D: Applied Physics, Vol. 4, No. 8, pp 1126-1133 (08/1971).

The Paschen curves of sparking potential as a function of the pressure - gap length product (pd) are given for normal pentane, hexane, heptane, octane and decane. The measurements of sparking potential have been made from a pd of about 30 Torr cm through the minimum sparking potential, about 1 Torr cm, to approximately 3E-3 torr cm. A previous empirical equation giving the sparking potential for values of pd greater than minimum sparking potential has been modified by the addition of two constants and an extra term, so that it now fits the Paschen curves for the whole of the extended range of the measurements. The retaining the constants introduced by previous work. Values of the constants are tabulated for the hydrocarbons listed above and a detailed comparison between the sparking potentials calculated from the equation and experimental results is given for octane. 9 Refs.

Primary Keywords: Hydrocarbon Gas; Several Gases; Paschen Curve; Empirical Equation

COPYRIGHT: 1971 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8161
(BREAKDOWN STUDIES)
(Exploding Wires)

THE BEHAVIOR OF INPUT-POWER DENSITY IN EXPLODING-WIRE RESTRIKES

A.L. Vlasov
Royal Institute of Tech. Stockholm, Stockholm, Sweden
Journal of Applied Physics, Vol. 43, No. 4, pp 1985-1987 (04/1972).

The input power per unit volume of the restrike channel of thin exploding wires reaches its maximum slightly before the electrical conductivity has reached its maximum. In its turn, the electrical conductance σ reaches its maximum before the current and the total power input. σ and I have reached their maxima but slightly after the i/d value observed on the voltage oscillograms. The reason why the input power per unit volume and the electrical conductivity reach their maxima much earlier than the current and the total power input I seems to be closely connected with the magnetogasdynamics of the restrike channel, which have not yet been satisfactorily treated because of the complexity of the problem. 3 Refs.

Primary Keywords: Exploding Wire; Current Pause; Current Restrike; Input Power; Plasma Conductivity; Magnetogasdynamics

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8164
(BREAKDOWN STUDIES)
(Liquid, Electrical)

THEORY OF BREAKDOWN OF THIN LIQUID DIELECTRIC LAYERS

G.S. Kuchinskii
Soviet Physics-Technical Physics, Vol. 11, No. 7, pp 964-969 (01/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1297-1304 (July 1966)

The breakdown of thin liquid dielectric layers of thickness of the order of 1E-3 cm is of considerable significance in the treatment of partial discharges initiated in layers of insulating material (e.g. paper impregnated with a dielectric fluid). In this case the initial partial discharges are struck in layers of the impregnating compounds between layers of the solid insulator in the normal technological practice of drying and impregnation. This paper discusses the theory of breakdown in thin layers of liquid dielectric, using mineral oil as an example. 12 Refs.

Primary Keywords: Liquid Breakdown; Thin Layer; Partial Discharge; Insulation Breakdown; Townsend Coefficient Measurement

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8165
(BREAKDOWN STUDIES)
(Solid, Electrical)

TIME LAGS IN THE ELECTRICAL BREAKDOWN OF GLASS IMMersed IN WATER

R.H. Azam and H. Dickinson
University College of Swansea, Singleton Park, Swansea, Wales

British Journal of Applied Physics, Vol. 12, pp 419-420 (08/1961).

When measuring the electric breakdown strength of cover glass

immersed in deionized water, time lags to breakdown were observed.

The mean statistical time lag was (12 sec^{-1}) microsec. The breakdown

strength between spherical electrodes was found to be (11.4 sec^{-1}) \times

10^6 V/cm . 8 Refs.

Primary Keywords: Cover Glass Breakdown; Water Insulation; Sphere

Electrodes; Delay Measurement.

COPYRIGHT: 1961 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8166
(PULSE GENERATORS; POWER CONDITIONING)

(Capacitors; Heating Resistors)

TIME-DEPENDENT CRITICAL DAMPING OF A CAPACITOR-DISCHARGE CIRCUIT

H. Piller, P.C. Archibald and J.N. Johnson
Naval Weapons Center, China Lake, CA 93555

Journal of Applied Physics, Vol. 42, No. 12, pp 4899-4901 (11/1971).

Optimal design of a heat-sensitive variable resistor in the circuit of a pulsed capacitor discharge provides a physically simple method of damping without the ringing currents which may shorten capacitor life. Computer simulation is utilized to determine the optimum design parameters and materials of the variable resistor. 3 Refs.

Primary Keywords: Pulse Generator; Spark Gap; Ringing Circuit;

Capacitor Damage; Nonlinear Damping Resistor

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

8167
(BREAKDOWN STUDIES)

(Liquid, Electrical)

USE OF THE DIMENSIONAL AND SIMILARITY METHODS IN INVESTIGATING PULSE DISCHARGE IN WATER

I.Z. Okun
Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1267-1273

(03/1968). Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1729-1738 (September 1957)

The present article is concerned with the discharge of a storage capacitor across the discharge gap in water. By using the dimensional and similarity methods and some other considerations, we shall derive the relationships determining the amplitude of cylindrical compression waves in liquid and the portion of the energy released in the channel that is transformed into the energy of the cylindrical compression wave. Similarity criteria which make it possible to simulate pulse discharge in the same liquid were obtained. The similarity relationships were checked experimentally. We also derived criteria which secured the similarity of only the electric characteristics of discharge. The discharge channel shape was stabilized (straightened) by means of a thin wire (Nichrome, $d = 0.03$ mm). 6 Refs.

Primary Keywords: Water Gap; Numerical Calculation; Simulation; Cylindrical Geometry; Compression Wave; Theory; Experiment; Discharge Stabilization.

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

8168
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

VACUUM BREAKDOWN WITH NANOSECOND PULSES

H.V. Belkin and E.A. Avilov
Soviet Physics-Technical Physics, Vol. 15, No. 8, pp 1739-1740

(02/1970). Trans. From: Zhurnal Tekhnicheskoi Fiziki 40, 1725-1726 (August 1970)

The time response of 1-2 mm long vacuum gaps to the application of 200 ns nanosecond pulses is studied. It is found that an increase of the pulse factor from 1.5 to 3.2 reduces the decay time of the voltage pulse across the gap from 55 to 5 nsec. 7 Refs.

Primary Keywords: Vacuum Gap; Millimeter Gap; Hemispherical-plane Gap; Disc-plane Gap; Voltage fall

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

8170
(PULSE GENERATORS; PULSE GENERATORS)

(IC Systems) VOLTAGE-MULTIPLICATION OF STEEP PULSES

G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 6, pp 1097-1100 (12/1963). Trans. From: Pribory i Tekhnika Eksperimenta 6, 95-97 (November-December 1963)

It is shown that if LC networks are connected in series through spark discharge gaps DG, and if the capacitance and inductance of each subgap loop are lower than those of the previous one by one order of magnitude approximately, a voltage $U_{\text{sub}} \approx 2^{n-1} U_0$ may be obtained across the capacitor $C_{\text{sub}} \approx 2^n C_0$, U_0 being the input voltage. The influence of the internal loop resistances and of the capacitance-inductance ratio of adjacent loops upon the value of U_{sub} is calculated. The obtained expressions are verified by experiment. 3 Refs.

Primary Keywords: IC Generator; Series Connection; Voltage Multiplication; 10 ns Rise Time; Design Considerations; Experimental Verification

COPYRIGHT: 1963 PLenum Press, REPRINTED WITH PERMISSION

8171
(BREAKDOWN STUDIES)
(Gas, Electrical)

FAST ELECTRONS AND X-RAY RADIATION DURING THE INITIAL STAGE OF GROWTH

OF A PULSED SPARK DISCHARGE IN AIR

Yu.L. Stankevich and V.G. Kalinin
Soviet Physics-Doklady, Vol. 12, No. 11, pp 1042-1043 (05/1968).

Trans. From: Doklady Akademii Nauk SSSR 177, 72-73 (November 1967)

In order to explain the mechanism of formation of a spark discharge in gases at high pressure, it is necessary to consider the energy of avalanche electrons during the initial stage of the discharge. It has been shown that for voltages close to the static breakdown value, the kinetic energy of an electron in a isolated avalanches does not exceed several electron volts. However, when the avalanche grows into a streamer the field in the vicinity of the avalanche should increase by several times. When this occurs, an electron during each "free path can acquire more energy than is required to compensate the losses during elastic collisions, excitation, and ionization. Under these circumstances the electron is continually accelerated and in some instances can acquire an energy comparable to the applied voltage. 3 Refs.

Primary Keywords: Avalanche Breakdown; Streamer Formation; Bremsstrahlung Radiation; Electrode Material Effect

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

8172
(REVIEWS AND CONFERENCES; ENERGY STOPPAGE; INDUCTIVE, CIRCUIT CALCULATIONS)

(Reviews; Inductors; Inductance)

INDUCTANCE CALCULATIONS: WORKING FORMULAS AND TABLES

F.W. Grover
Union College

Publisher: General Publishing Company Ltd. (01/1946).

This book is a treatise on inductance calculation and inductor design. The author begins with a short discussion of the basic theory of inductance and proceeds to present general and specific calculations for several coil designs. Geometry considerations, such as calculation of mean distances between wires of various cross sections and corrections for large cross section wires, are considered in some detail. Compact working formulas for several common coil configurations are presented along with examples of their use. The effect of high frequencies or coil performance is discussed. 119 Refs.

Primary Keywords: Inductance Calculations; Basic Theory; Working Formulas; Several Coil Configurations; Geometry Considerations; High Frequency Corrections

COPYRIGHT: 1946 FREDERICK W. GROVER

8173
(REVIEWS AND CONFERENCES)

(Reviews)

AN INTRODUCTION TO HIGH-VOLTAGE EXPERIMENTAL TECHNIQUE

D. Kind
Technische Universität Braunschweig, Braunschweig, FRG

Publisher: Friedr. Vieweg & Sohn Verlagsgesellschaft mbH, Braunschweig (01/1978)

The fundamentals of high voltage technique should be studied not only by someone entering the field of high voltage engineering, but should be reviewed periodically by everyone that utilizes high voltages. This book provides an introduction to the basics of high voltage AC, DC, and impulse voltage generation and measurement; non-destructive testing; safety; and laboratory organization consistent with the principles discussed. The book includes several safe and simple experiments to familiarize novices with high voltage technique. Rigorous mathematics are not included so that the student need not have an advanced education to benefit from the information included. 126 Refs.

Primary Keywords: Review; AC Voltage; DC Voltage; Impulse Voltage; Generation; Measurement; Safety; Laboratory Layout; Simple Experiments

COPYRIGHT: 1978 FRIEDR. VIEWEG & SOHN VERLAGSGESELLSCHAFT MBH, BRAUNSCHWEIG

8174
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)

(Reviews; Reviews)

ELECTRICAL BREAKDOWN OF GASES

J.M. Monk Ed. and J.D. Gregg Ed.

University of Liverpool, Liverpool, UK

Publisher: John Wiley & Sons (01/1978).

Electrical breakdown is a very complex phenomenon that is very difficult to put completely into words. This book does just that. A well-illustrated introduction by Monk and a foreword by J.D. Gregg, the book includes eleven chapters in fundamentals of breakdown, vacuum breakdown, spark breakdown in uniform and nonuniform fields, corona, effect of radiation and laser initiated breakdown, RF breakdown, time delay and voltage fall, and electrode effects. Each chapter is written by an expert in the field and is both complete and accurate. Each chapter also contains many useful references for a more detailed treatment. 195 Refs.

Primary Keywords: Electrical Breakdown; Fundamental Process; Vacuum Breakdown; Spark Breakdown; Uniform Field; Nonuniform Field; Corona; Voltage Fall; Time Lag; Radiation; Laser Breakdown; RF Breakdown; Channel Characteristics

COPYRIGHT: 1978 JOHN WILEY & SONS, LTD.

8175
(BREAKDOWN STUDIES)

(Gas, Electrical)

PULSED ARCS IN ARGON AT PRESSURES UP TO 10⁸ N/m²/sup 2/ (1000 ATM)

F.S. Borovik, V.P. Kantsedel, Yu.R. Knyazev, R.V. Mitin and V.I. Petrenko

Soviet Physics-Technical Physics, Vol. 12, No. 4, pp 502-506 (10/1967). Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 703-709 (April 1967)

This paper describes an apparatus which can be used to investigate pulsed arcs in argon at pressures up to 10⁸ N/m²/sup 2/, currents up to 50 kA, and pulse lengths of approximately 1E-3 sec. The high pressure is obtained by the evaporation of liquefied argon in a closed space. The parameters of the plasma formed in the discharge are: charged particle density up to approximately 4E19 cm⁻³/sup -3/, temperature approximately 1E4 Deg.K. and degree of ionization almost unity. Radiation absorption processes are shown to play a significant role in such plasmas. 1 Ref.

Primary Keywords: Pulsed Arc; Very High Pressure; Argon Gas; Very High Plasma Density; Low Temperature; High Ionization

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH

PERMISSION

8176

(BREAKDOWN STUDIES)
(Vacuum, Electrical)
CATHODE EMISSION MECHANISM IN AN ARC DISCHARGE

V.I. Rakhovskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 10, No. 12, pp 1707-1709 (06/1966).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 35, 2228-2231 (December 1965)
The theory of the vapor cathode was first proposed by Slepian about forty years ago. The idea of using a vapor cathode was subsequently proposed by Rothstein, who suggested an entirely new concept of the possibility of metal-type conductance in the cathode vapor cloud due to a high concentration of neutral particles in that region. A reappraisal of Rothstein's ideas in the light of new developments is the object of this article. At the present time the emission processes in cathodes made from materials with high vapor pressure and low melting and boiling points (Mg, Ag, Cu) are attributed to field emission. It is assumed that the electron emission occurs at the metal surface in an extremely large (approximately $10^7 - 10^8 \text{ V/cm}$) electric field; this field is generated by the ion space charge at the surface which causes the field emission. 16 Refs.

Primary Keywords: Vacuum Breakdown; Vapor Virtual Cathode; Ion Impact; Cathode Heating; Hot Spots; Field Emission
COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8177

(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Materials; Liquid Gaps, Materials)

DESTRUCTION OF ELECTRODES BY ELECTRIC DISCHARGES OF HIGH CURRENT DENSITY

V.E. Il'in and S.V. Lebedev
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 7, No. 8, pp 717-721 (02/1963).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 32, 986-992 (August 1962)

A possible mechanism for the erosion of electrons is considered on the basis of an assumption as to the decisive role of Joule heat. It is shown that, for a current density on the electrode surface $j < 10^6 \text{ A/sec/cm}^2$, the Joule model correctly describes the qualitative aspects of the fundamental characteristics of the erosion. 29 Refs.

Primary Keywords: Electrode Erosion; Anode Erosion; Cathode Erosion; Electrode Heating Model; Air Gap; Kerosene Gap
COPYRIGHT: 1963 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8178

(BREAKDOWN STUDIES)

(Electrodes)
DETERMINATION OF THE ELECTRIC FIELD ENHANCEMENT FACTOR AND CRATER DIMENSIONS IN ALUMINUM FROM SCANNING ELECTRON MICROGRAPHS

R. Hackam
University of Sheffield, Sheffield, UK
Journal Of Applied Physics, Vol. 45, No. 1, pp 114-118 (01/1974).

An electron scanning microscope is used to examine the surfaces of an aluminum cathode and an aluminum anode which have been subjected to repeated spark erosion under an ultrahigh vacuum (10^{-9} Torr), at voltages of up to 45 kV. The cathode surface is observed to contain large numbers of protrusions which give rise to an enhanced local electric field at the tip of the protrusions. The field enhancement factor, Beta, at the microprojections is determined from the scanning electron micrographs. The values of Beta are in reasonable agreement with those obtained from the Fowler-Nordheim theory when applied to the current-voltage measurements in the region prior to breakdown. The anode surface is completely devoid of protrusions and contains large numbers of craters. The diameters and depths of typical craters are also determined. 41 Refs.

Primary Keywords: Vacuum Breakdown; Aluminum Electrodes; Cathode Microprojections; Anode Craters; Field Enhancement Factor; Fowler-Nordheim Theory
COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8179

(BREAKDOWN STUDIES)
(Electrodes)

EFFECT OF ELECTRODE ROUGHNESS ON BREAKDOWN VOLTAGE

V.A. Avrutskii
Moscow Power Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 3, pp 389-393 (09/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 191-1920 (October 1967)

Experimental data are given on the electrical strength and statistical scatter in the breakdown voltages for gaps with electrodes with rough surfaces for air pressures of 1-5 atm (absolute). The surface state is checked before each series of strength measurements. The experimental results are compared with theory via expressions that allow for the effect of irregularities of the cathode surface on the electrical strength of the gap. Expressions are derived for the breakdown probability distribution as a function of voltage; these are in good agreement with the experimental statistical characteristics. 7 Refs.

Primary Keywords: Cathode Microprojections; Field Enhancement; Several Discharges; Breakdown Voltage Scatter; Experiment; Comparison With Theory
COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8180

(BREAKDOWN STUDIES)

(Electrodes)
EFFECT OF ELECTRODE ROUGHNESS ON THE ELECTRICAL STRENGTH OF COMPRESSED GASES

V.A. Avrutskii, G.M. Goncharenko and F.N. Prokhorov
Moscow Power Engineering Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 18, No. 3, pp 386-388 (09/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 615-619 (March 1973)

Using the Townsend mechanism, the effect of impact ionization processes on the electrical strength of compressed gases is studied in the strong field of electrode surface microirregularities. A self-maintained discharge condition is derived for the case in which the microprojections of the surface are shaped like a prolate semiaxisoid of revolution. Good agreement between the calculations and the corresponding measured data is obtained for air, nitrogen, and hydrogen if the height of the microprojections used in the calculations is $11.3 - 15.6 \text{ cm}$. 14 Refs.

Primary Keywords: Cathode Microprojections; Field Enhancement; Theory; Prolate Semiaxisoid Of Revolution; Numerical Calculation; Comparison With Experiment
COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8181

(BREAKDOWN STUDIES)

(Gas, Electrical)

ELECTRICAL BREAKDOWN IN CSF/SUB 8/

R. Gaballa and F.S. Linn
University of Washington, Seattle, WA
Journal Of Applied Physics, Vol. 21, No. 1, pp 592-596 (01/1950).
The breakdown potential of a new gas, CSF/sub 8/, has been measured over the range from $\rho \times d = 4$ to $200 \text{ mm} \times \text{cm}$ under conditions approximating plane parallel geometry. A comparison of breakdown in air, Freon 12 and CSF/sub 8/ in the same apparatus indicates the ratio of the strengths of these gases to be approximately 1.2:3, respectively. CSF/sub 8/ decomposes rapidly during breakdown into CF/sub 4/ and SF/sub 4/ with a consequent doubling of pressure and appreciable increase in breakdown potential. 12 Refs.

Primary Keywords: CSF/sub 8/ Gas Breakdown; Parallel-plane Electrodes; Freon; Air; Comparison; Decomposition Products
COPYRIGHT: 1950 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8182

(SWITCHES, CLOSING; ELECTROMAGNETIC LAUNCHERS)

(Vacuum Gaps, Materials; Railguns, Materials)

ELECTRODE EROSION IN SPARK DISCHARGES

D.J. Vargo and F.L. Taylor
Lewis Research Center, Cleveland, OH
Journal Of Applied Physics, Vol. 33, No. 9, pp 2911-2912 (09/1962).
Performance of rail-type plasma accelerators may be strongly affected if electrode erosion processes add mass to the moving plasma. The dependence of the erosion rate on the characteristics of the discharge has not been clearly defined in previously published data. Therefore, in the study of a zero length plasma accelerator, an attempt was made to determine the electrode erosion characteristics of capacitor discharge systems in high vacua ($3 \times 10^{-6} \text{ mm Hg}$). 3 Refs.

Primary Keywords: Plasma Accelerator; Rail Gun; Electrode Erosion; Vacuum Discharge; Dependence On Waveform
COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8183

(BREAKDOWN STUDIES)

(Exploding Wires)

EXPERIMENTAL STUDY OF ELECTRICAL EXPLOSION

B.P. Perepud and K.B. Abramova
Soviet Physics-Doklady, Vol. 9, No. 8, pp 665-668 (02/1965).

Trans. From: Doklady Akademii Nauk SSSR 157, 837-840 (August 1964).
The first paper devoted to a study of electric explosion of fine metal wires and foils dates from the year 1776. Although a number of papers have been published on the question, electrical explosion has still not been investigated to a sufficient extent. A study has been made of electrical explosion of copper wires at the A.F. Ioffe Physicotechnical Institute, AN SSSR. Most attention was given in this work to the energy side of the matter and to the accompanying radiation process. The most important results of this study are given in the present paper. 6 Refs.

Primary Keywords: Exploding Wire; Threshold; Wire Voltage; Wire Current; Photographic Diagnostic; Comparison With Black Body Radiation
COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8184

(SWITCHES, OPENING)

(Explosive Fuses)

EXPLODING FOIL DEVICES FOR SHAPING MEGAMP CURRENT PULSES

R. Bealting and P.G. Carpenter
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
Journal Of Physics E: Scientific Instruments, Vol. 5, pp 889-892 (05/1972).

High speed condenser banks provide pulsed magnetic fields for impulsive loading experiments. The capability of the methods can be extended by using exploding foil to shape the current that forms the magnetic field. Two circuit applications, the crowbar switch and dynamic damping resistance, are detailed and their use in pulse shaping is illustrated. The necessary principles of exploding foil integrals for a range of common foil materials are given. The multichannel crowbar switch described is novel in that it requires no ancillary circuitry and is timed automatically by the primary bank discharge. An exploding foil ruptures insulant mechanically in many sites, giving a low inductance closure 0.3 microseconds after the foil explodes. 2 Refs.

Primary Keywords: Exploding Foil; Pulse Shaping; Capacitor Discharge; Nonlinear Resistor; Low Inductance
COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8185

(BREAKDOWN STUDIES)

(Gas, Electrical)

INVESTIGATION OF A CYLINDRICAL, AXIALLY BLOWN, HIGH-PRESSURE ARC

H. Hermann, U. Kogelschatz, K. Regaller and E. Schade
Brown, Boveri & Co Ltd, Baden, Switzerland
Journal Of Physics D: Applied Physics, Vol. 7, No. 4, pp 607-619 (03/1974).

An experimental arrangement for the production of a quasi-stationary, high-current arc is described. It is stabilized by an axial gas flow in a high-pressure environment (current: 1900 A, pressure: 23 atm, gas: nitrogen). The conditions are described under which part of the arc assumes a cylindrical form. For such an arc the radial temperature distribution was measured. Because of the cylindrical shape a relatively simple evaluation yields quantitative data about the local radiative energy balance and the other energy transport mechanisms. This leads, for the first time, to a quantitative understanding of the different physical processes in this arc, and makes it possible to formulate a simplified arc model which is useful in practical applications. 22 Refs.

Primary Keywords: High-current Arc; Nitrogen Arc; Axially Flowing Gas
COPYRIGHT: 1974 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

860

8186
(SWITCHES; CLOSING)
(Gas Gaps, Optical)

INVESTIGATION OF THE CHARACTERISTICS OF FAST-RESPONSE SEALED DISCHARGERS TRIGGERED BY LASER RADIATION
L.N. Bykhovskaya, I.M. Guravich, V.V. Lopukhin and L.F. Selivanova
All-Union Institute, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 7, No. 8, pp 968-971
(08/1977).

Trans. From: *Kvantovaya Elektron. (Moscow)* 4, 1708-1713 (August 1977)
An investigation was made of new sealed ceramic dischargers with a wave impedance of 50 ohm triggered by a train of picosecond pulses or by pulses of 100 nsec duration and 1060 nm wavelength. The minimum triggering energy was 2E-6 - 5E-7 J and the duration of the leading edge of the resultant voltage pulses was approximately 0.5 nsec. The dependences were obtained of the discharger delay time $t/\text{sub d}$ on the triggering energy and the voltage across the electrodes. The conditions were found under which the delay time was $t/\text{sub d} \ll 1$ nsec and the scatter of the delay time was delta $t/\text{sub d} \ll 1$ nsec.
13 Refs.

Primary Keywords: Sealed Ceramic Switch; 50 Ohm Impedance; Nd-Glass Laser; Mode-Locked Laser; Q-Switched Laser.

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8188
(DIAGNOSTICS AND INSTRUMENTATION)
(Current)

LOW-RESISTANCE SHUNTS FOR IMPULSE CURRENTS

A.J. Schmid
University of Karlsruhe, Karlsruhe, FRG
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 5, pp 2251-2257 (10/1971).

In high-voltage technology, plasma physics and power electronics low-ohmic resistors are frequently employed to measure high, rapidly changing currents. Their voltage drop is adversely affected by stray inductances and skin effect. A more complete analysis of low-ohmic tubular type and squirrel cage type resistors including such effects is presented. This paper also describes a compensation network of passive electronic components that permits improved measurement of high energy impulse currents. 12 Refs.

Primary Keywords: Current Shunt; Resistive Design; Stray Inductance; Skin Effect; Tubular Shunt; Squirrel Cage Shunt

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

8189
(INSULATION, MATERIAL)
(Gas)

THE DIELECTRIC STRENGTH OF GASEOUS FLUOROCARBONS

W.A. Wilson, J.H. Simons and T.J. Brice
Pennsylvania State College, State College, PA
Journal Of Applied Physics, Vol. 31, No. 3, pp 203-205 (03/1960).
The sixty-cycle dielectric strengths of some gaseous fluorocarbons have been measured between three differently shaped electrode pairs at pressures up to three atmospheres. The breakdown potentials for propene, butane, and pentane are found to be, at first instances, to be equal to or greater than those for sulfur hexafluoride under comparable conditions, and to be far greater than those for nitrogen. Fluorocarbons thus have possible uses as gaseous insulators in high voltage apparatus. 4 Refs.

Primary Keywords: Fluorocarbon Insulation; Propene; Butane; Pentane; SF₆; Relative Breakdown Voltage; Power Line Frequency

COPYRIGHT: 1950 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8190
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE EFFECT OF PRESSURE ON THE POSITIVE POINT-TO-PLANE DISCHARGE IN N/SUB 2/, O/SUB 2/, CO/SUB 2/, SO/SUB 2/, SF/SUB 6/, Cl₂/SUB 2/F/SUB 2/, A, He, And H/SUB 2/

H.C. Pallec and F.S. Cooper
General Electric Co., Schenectady, NY 12301
Physical Review, Vol. 56, No. 2, pp 170-175 (07/1939).
The voltage at which corona first appears in a 3-mm point-to-plane gap and the breakdown voltage of the gap have been determined with N₂, O₂, CO₂, SO₂, SF₆, Cl₂, F₂, Ar, He, and H₂ at certain mixtures of these gases. This has been done with both positive and negative point polarity and over a pressure range of about 30 atmospheres. In the mixtures which were observed are discussed the ionization and the marked dependence of the positive point breakdown voltage on pressure in those gases which form negative ions. 7 Refs.

Primary Keywords: Breakdown Voltage; Corona Voltage; Point-Plane Gap; Several Gases; Variable Pressure; Ion Polarization

COPYRIGHT: 1939 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION

8191
(PULSE GENERATORS)
(Line Type)

A HIGH-POWER RF LINE GENERATOR OF NUVEL DESIGN

W.M. Hughes, I.R. Jones and M.G.R. Phillips
Flinders University of South Australia, Australia
Journal Of Physics E: Scientific Instruments, Vol. 13, pp 276-278 (03/1980).

A modification of the Nuvel radio frequency line generator is described. The modification substantially reduces the necessary number of spark gap switches and yields both a significant saving in construction costs and a greater ease of construction and reliability of operation. The construction and performance of an eight-period line generator incorporating this design modification are described. The equivalent load is 14.1 kV and 9.7 μ A. 8 Refs.

Primary Keywords: Modulated Weibel Pulse Generator; Fewer Spark Gaps;

15 kV Output

COPYRIGHT: 1980 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8193
(PULSE GENERATORS; SWITCHES; CLOSING)

(Capacitive; Relays)

A HIGH-VOLTAGE MERCURY-WETTED PEEL PULSE GENERATOR WITH SECONDARY PULSE SUPPRESSION

T.J. Godfrey, R.M. Crips and G.D.W. Smith
University of Oxford, Oxford, UK
Journal Of Physics E: Scientific Instruments, Vol. 10, pp 329-330 (04/1977).

A simple electronic circuit has been developed to eliminate the secondary pulses obtained when mercury-wetted reed relays are used for producing high-voltage pulses in the nanosecond region at high repetition rates. 5 Refs.

Primary Keywords: Mercury-Wetted Peal Switch; Capacitor Discharge; Secondary Pulse Suppression; Vacuum; Triode Counter

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8194
(POWER CONDITIONING; SWITCHES; CLOSING)
(Diodes; Gas Gaps, Electrical)

A KILAMPERE CURRENT DIODE BASED ON THE QUENCHED SPARK PRINCIPLE
E. Panarella and V. Gutu
National Research Council, Ottawa, Ontario, Canada
Journal Of Physics E: Scientific Instruments, Vol. 7, pp 835-841 (10/1974).

A novel type of unidirectional current device is described, particularly useful in a resonant RLC circuit with kiloamperes current flow. Basically, the device is a high voltage spark gap switch where the single switching spark has been replaced by a series of elementary sparks generated by a set of copper plates. The unidirectional property of the current is achieved by the behaviour of the current during the discharge. There, being in contact with the copper plates, are cooled and deionized as soon as the current flow reduces to zero in the oscillatory circuitry. The resistance of the circuit then becomes very large and no reversal in the current direction is possible. In this respect, the circuit behaviour is similar to one in which a diode is incorporated. Detailed information on the mechanical design of the switch is given and it is shown that the electrical parameters for which the device can find application are in the range of several tens of kilovolts and kiloamperes and power flow in the range of several megawatts. 10 Refs.

Primary Keywords: High Current Diode; Multiple Spark Gaps; Quenched Spark Gap

COPYRIGHT: 1974 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8195
(SWITCHES; CLOSING)
(Frytron)

A LASER-TRIGGERED KRYTRON-BLUMLEIN ELECTRO-OPTIC SWITCH
R.L. Hyde, D. Jacoby and S.A. Ramsden
University of Hull, Hull, UK
Journal Of Physics E: Scientific Instruments, Vol. 10, pp 1106-1107 (11/1977).

A Krytron, triggered by focusing the output from a mode-locked Nd-YAG oscillator on to its grid, is used to discharge a Blumlein into a Pockels cell switch to isolate a single pulse from the mode-locked train. 10 Refs.

Primary Keywords: Laser-Triggered Krytron; Blumlein Line; Nd-YAG Laser; Mode Locked Laser

Secondary Keywords: Pockels Cell

COPYRIGHT: 1977 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8198
(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Electrodes; Gas Gaps, Materials)

CARBON SEGREGATION AND ARC DAMAGE OF TUNGSTEN ELECTRODES

F.W. Ostermayer Jr. and F.B. Koch
Bell Labs, Murray Hill, NJ 07974
Applied Physics Letters, Vol. 36, No. 4, pp 266-268 (02/1980).
Eruptions that occur on tungsten electrodes after repeated 35-A arcs of 1.44-msec duration have been studied with a scanning Auger microscope and found to contain high concentrations (20-30 at.%) of carbon. This is much greater than the average carbon concentration in the tungsten and in the vicinity of the HNO₃-H₂O mixture at 25 at.%. Further evidence that the spots are rich in W₂C comes from their solubility in hot HNO₃/H₂O. Therefore it appears that carbon progressively segregates in the arc spots due to its low solid solubility in tungsten and the resultant lowering of the melting point is responsible for the eruptions. 5 Refs.

Primary Keywords: Electrode Erosion; Tungsten Electrodes; 35 A Arcs; 1 ms Duration; Anode Peaks; No Cathode Erosion

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8199
(BREAKDOWN STUDIES)

(Gas, Electrical)

COMPOSITION AND PROPERTIES OF A SULPHUR HEXAFLUORIDE ARC PLASMA

P.J. Lambright
University of Manchester, Manchester, UK
British Journal Of Applied Physics, Vol. 18, pp 419-426 (04/1967).
The particle composition and the electrical and thermal conductivities of an SF₆ arc plasma have been calculated. The significant differences between the properties of SF₆ and those of nitrogen or air have been shown to explain the different behavior of the arc transition arcs in the two media. In particular, the electrical conductivity of SF₆ when used in circuit arcs is decreased. 22 Refs.

Primary Keywords: SF₆ Arc; Plasma Composition; Low Arc Voltage Arcs; Filamentary Arc; Strong Temperature Dependence

COPYRIGHT: 1967 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8200
(BREAKDOWN STUDIES)

(Gas, Electrical)

COMPOSITION AND TRANSPORT PROPERTIES OF SF/SUB 6/ AND THEIR USE IN A SIMPLIFIED ENTHALPY FLOW ARC MODEL

J.S. Frost and P.W. Lieboldsen
Washington Research and Development Center, Pittsburgh PA
Proceedings Of The IEEE, Vol. 59, No. 6, pp 674-683 (06/1971).
The equilibrium composition of SF₆ was calculated for temperatures from 1000 to 45000 Deg K and for pressures from 1 to 16 atm. The usual thermodynamic functions and transport properties were also computed. Considering the arc column in axially flowing gas as a plasma generator, the power balance and momentum conservation equations are formulated and solved with certain simplifying assumptions. The solution gives the developing flow and electrical parameters as a function of distance along the nozzle. Arc voltages are predicted which agree with available data. Clarification is given on two processes contributing to dielectric recovery: axial sweeping away of the arc channel, and its conductance decay by thermal diffusivity, during the current fall approaching current zero. 25 Refs.

Primary Keywords: SF₆ Arc; Plasma; Composition; Transport Properties; Flowing Gas; Effect On Arc Extinguishing

COPYRIGHT: 1971 IEEE. REPRINTED WITH PERMISSION

8203
(BREAKDOWN STUDIES)
(Gas; Electrical)

THEORETICAL PROPERTIES OF SPHEROIDALLY-SYMMETRIC STATIC ARCS

A.K. Helder and D. Whittaker
University of Liverpool, Liverpool, UK
British Journal of Applied Physics, Vol. 18, pp 427-441 (04/1967).

A steady-state spheroidally-symmetric discharge with losses solely by conduction is analysed theoretically and its main properties summarized in dimensionless form in a nomogram. Included as special cases are the unbounded arc, the cylindrical arc and the filled-tube model. Radial variations are described by Legendre functions of complex degree. 5 Refs.

Primary Keywords: Steady-state Arc; Conduction Lasers; Nomogram; Unbounded Arc; Cylindrical Arc; Thermal Equilibrium

COPYRIGHT: 1967 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8205
(REVIEWS AND CONFERENCES; POWER TRANSMISSION)
(Reviews: Transmission Lines)

TRANSMISSION LINES WITH PULSE EXCITATION

H.G. Booker Ed. and H. Declaris Ed.

Publisher: Academic Press, Inc. (London) Ltd. (01/1969).

The transmission of electrical signals is essential for research in pulsed power. Transmission lines under pulsed and sinusoidal excitation are considered in this book. The general equations are derived for general transmission lines, including losses and then are shown to simplify to the lossless case. Approximate Laplace transforms are introduced and several simple line geometries are solved as examples. The Bergeron diagram is demonstrated by example and lumped and nonlinear problems are shown to be solvable by this method. Sinusoidal solutions are given for several geometries using planar notation. Pulse distortion by losses is discussed in detail with a brief discussion of dispersion included. 0 Refs.

Primary Keywords: Transmission Line; Basic Equations; Losses; Laplace Transform Solution; Graphical Solution; Pulse Distortion; Reflections

COPYRIGHT: 1969 MASSON AND CIE., PARIS

8215
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas; Optical; Gas Gaps; Optical)

ELECTRON DENSITIES IN LASER-TRIGGERED HYDROGEN SPARKS

S.K. Dhal, R.F. Williams, R.J. Crumley and M.A. Gunderson
Texas Tech University, Lubbock, TX 79409
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 164-167 (09/1980).

We have used Stark broadening measurements of the $N_{\text{H}}/\text{sub Beta}$ emission line to determine the temporally and spatially resolved electron density in laser-triggered hydrogen sparks. In this paper the results of this work are presented and compared with earlier work on conventional overvolted sparks. 14 Refs.

Primary Keywords: Laser-triggered Breakdown; $N_{\text{H}}/\text{sub 2}$; Laser; Uniform Field Breakdown; Hydrogen Gas; Electron Density Profile; Stark Broadening

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8225
(PULSE GENERATORS)
(Capacitive)

A PULSE CIRCUIT FOR EXCITATION OF A PARTICLE ACCELERATOR ELECTROMAGNET
E.I. Lukinov, V.D. Samenov and E.G. Furman
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 6, pp 1563-1564 (12/1974).
Trans. From: Pribyl i Tekhnika Ekspertimenta 6, 17-19 (November-December 1974)

A new method of betatron electromagnet excitation is considered using current pulses of quasi triangular form. The energy storing capacitor operates in a unipolar mode with respect to voltage and the pulse repetition frequency is regulated. 5 Refs.

Primary Keywords: Pulse Generator; Triangular Output; Partial Capacitor Discharge; Thyristor Switch

Secondary Keywords: Betatron Magnet

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

8229
(BREAKDOWN STUDIES)

(Vacuum; Electrical)

ATMOSPHERIC EFFECTS ON THE DIELECTRIC STRENGTH OF A VACUUM GAP WITH PROCESSED ELECTRODES

M.V. Tatarinova and N.E. Novikov
Engineering Physics Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 7, pp 905-906 (07/1977).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1568-1569 (July 1977).

High dielectric strengths in vacuum systems are achieved and maintained for considerable lengths of time. With molybdenum electrodes 1.7 cm in diameter, a vacuum gap of 1 mm can withstand a voltage 55-60 kV without a single breakdown for 50 h. The current in these experiments does not exceed 10^{-8} A at higher voltages and at the same time interval, the time delay before the first breakdown is shorter: 2 h at 70 kV and 20 min at 90-110 kV. The high dielectric strength is achieved by means of a glow discharge, through the removal of contaminants, through the removal of the surface layer damaged during the mechanical treatment, and through the formation of a surface microrelief by the discharge. Both electrodes are treated in an oil-free vacuum and in a pure inert gas. In this paper we report a study of the dielectric strengths of a vacuum system after electrodes processed in the manner described above are exposed to the atmosphere. The dielectric strength of the vacuum system is compared for gaps of $d=1$ mm and $d=0.5$ mm. 3 Refs.

Primary Keywords: Vacuum Breakdown; Electrode Conditioning; Exposure To Atmosphere; Change Of Breakdown Characteristic

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8230
(PARTICLE BEAMS; ELECTRON)
(Generation)

BEAM GENERATION IN FOIL-LESS DIODES

J. Chen and R.V. Lovelace

Cornell University, Ithaca, NY 14850

The Physics Of Fluids, Vol. 21, No. 9, pp 1623-1633 (09/1978).

A study is made of the generation of intense relativistic electron beams in rectangular and cylindrical foilless diodes. The diode space charge is treated self-consistently. The electron emission from the cathode is assumed to be space-charge-limited. A strong axial magnetic field is assumed to prevent the electrons from reaching the anode surface(s) directly, and to constrain the electron motion to be approximately one-dimensional. A useful dimensionless measure of the diode potential $\phi/\text{sub c}$ is $\epsilon/\text{sub p}$, where ϵ is proportional to $\phi/\text{sub c}$, c is the electron rest mass and charge, and the speed of light. Properties of the diodes are first analyzed in the ultra-relativistic limit, $\epsilon/\text{sub p} \gg 1$, where the condition for space-charge-limited emission gives rise to a linear singular integral equation. This equation is solved for rectangular diode geometry, and the solutions are studied in detail. In particular, the diode impedance is independent of $\phi/\text{sub c}$, and the beam area, in general, is hollow. The beam particle kinetic energy flux, $\Gamma/\text{sub p}/\text{sub c}$, decreases as the beam width, b , increases; for $b/\text{sub c} = \Gamma/\text{sub p}/\text{sub c}$, where b is the diode width. A treatment of the diodes is then given for small but nonzero values of $\epsilon/\text{sub p}$. For finite $\epsilon/\text{sub p}$, there is a nonrelativistic Child-Langmuir sheath of thickness approximately $\epsilon/\text{sub p}$ at the cathode surface. 12 Refs.

Primary Keywords: Field Emission Diode; Foilless Diode; Theory; Space-charge-limited Emission; Axial Magnetic Field; Numerical Calculation; 1-d Calculation

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8231
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas; Electrical; Electrodes)

CONDITIONS FOR INITIATION OF A DISCHARGE IN A SPHERICAL GAS GAP WITH A PLASMA CATHODE

Yu.E. Kreindel and N.Ya. Levine

Academy of Sciences of the USSR, Tomsk, USSR

Soviet Physics Journal, Vol. 17, No. 3, pp 383-386 (03/1974).
Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika 17,

113-117 (March 1974).

The flow of current in a gas gap between a concave plasma cathode and a positive electrode is considered. A simplified theoretical model is used to obtain the conditions for electrical breakdown and the equations for prebreakdown values of the current and the gap width. 8 Refs.

Primary Keywords: Gas Breakdown; Plasma Cathode; Plane Anode; Space-charge Layer; Prebreakdown Current; Variable Gap Spacing; Experiment; Theory

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

8233
(BREAKDOWN STUDIES)

(Exploding Wires)

DETERMINATION OF TEMPERATURE AND OTHER PARAMETERS OF AN EXPLODING-WIRE PLASMA BY SELF-REVERSAL OF LINES AND ABSORPTION SPECTRA

G.G. Il'lin, L.M. Kurnatov and I.S. Fishman

Kazan State University, Kazan, USSR

High Temperature, Vol. 13, No. 2, pp 266-271 (04/1975).
Trans. From: Teplotifizika Vysokikh Temperatur 13, 286-294 (March-April 1975).

Measurements are made on the plasma formed by an exploding copper wire of 0.15 mm diameter by means of time-resolved emission and absorption spectra. The radial distribution of the atomic density and the temperature are obtained using various copper emission lines. The temperature is found by the method of Bartels. 11 Refs.

Primary Keywords: Exploding Wire; Copper Wire; Plasma Diagnostics; Gap Spacing

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

8236
(BREAKDOWN STUDIES)

(Gas; Electrical)

DISSOCIATION OF SF₆/CF₄/CF₃ AND SF₆/CF₄ BY ELECTRON IMPACT

V.H. Dibeler and F.L. Mohler

Journal Of Research, Vol. 90, pp 25-29 (01/1985).

The dissociation by electron impact of SF₆/CF₄, CF₃, and SF₆/CF₃ has been studied with a consolidated mass spectrometer. Data are also given on the appearance potentials of various ions in the SF₆-CF₄ mixture and measurements of the isotopic abundance of sulfur, carbon, and silicon. The observed appearance potentials of the SF₆/CF₄ ion in SF₆/CF₄ and CF₃/CF₄ and the SF₆/CF₃ ion in SF₆/CF₃ were found to be lower than the calculated value assuming formation of a positive atom ion and a free electron, but nearly equal to the calculated value assuming the formation of a positive atom ion and a negative fluorine ion. The large relative abundance of the SF₆/CF₄++ ion and SF₆/CF₃++ and the CF₃/CF₄++ ion in SF₆/CF₃ is taken to indicate the formation of these ions by removal of two CF₃ ions in the former and possibly an SF₆ ion and a free electron in the latter case. 16 Refs.

Primary Keywords: Molecular Dissociation; Electron Impact; Ion Formation Probability; Mass Spectrometry Diagnostic

COPYRIGHT: 1985 UNITED STATES GOVERNMENT, REPRINTED WITH PERMISSION

8237
(BREAKDOWN STUDIES)

(Gas; Electrical)

EFFECT OF GAS PRESSURE ON ELECTRICAL BREAKDOWN AND FIELD EMISSION

D. Albert, D. Lee, E.M. Lyman and H.E. Tomaschke

University of Illinois, Urbana IL

Journal Of Applied Physics, Vol. 38, No. 2, pp 880-881 (02/1967).

In a recent paper, we presented a physical picture for the initiation of electrical breakdown between metallic electrodes in an ultra-high vacuum. Based on the enhancement of the electric field at sharp submicroscopic projections on the cathode, this picture related the initiation process to the properties of the probe charges. A physical mechanism for the onset of breakdown was proposed. One of the significant consequences of this work has been the development of a physical explanation for an effect which has often been noted but heretofore not understood. To explain this so-called gas effect, we assume as a starting point the breakdown model based on field emission from submicron-size projections. When gas is introduced, the significant decrease in field emission is here attributed to the selective sputtering of the emitting whiskers by ions formed in the volume by electron bombardment of the gas molecules. 8 Refs.

Primary Keywords: Gas Breakdown; Variation With Gas Pressure; Field Emission; Cathode Microprojections; Dependence On Microprojection Size

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8238
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

ELECTRON EMISSION PRECEDING ELECTRICAL BREAKDOWN IN VACUUM

R.P. Little and W.T. Whitney

Naval Research Lab., Washington, DC 20375

Journal of Applied Physics, Vol. 34, No. 8, pp 2438-2432 (08/1963).
An applied field of 165 V/cm produced electron emission from apparently smooth surfaces at room temperature. It is found experimentally that this prebreakdown emission is independent of emitter temperature up to 1000° Deg.K. Using a shadow electron microscope, projections about 2 micron high capable of producing field enhancements on the order of 100 have been found on optically polished cathodes at prebreakdown emission rates. This, with other evidence, strongly indicates that prebreakdown emission is Fowler-Nordheim field emission, due to a geometrical field enhancement. 11 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Temperature Dependence; Microprojections; Fowler-Nordheim Equation

COPYRIGHT: 1963 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8239
(PARTICLE BEAMS, ELECTRON)
(Generation)

EXACT RELATIVISTIC SOLUTION FOR THE ONE-DIMENSIONAL DIODE

H.R. Jory (1) and A.W. Trivelpiece (2)

(1) Varian Associates, Palo Alto, CA 94304

(2) University of Maryland, College Park, MD 20742

Journal of Applied Physics, Vol. 40, No. 10, pp 3924-3926 (09/1969).

Exact relativistic solutions for the one-dimensional space-charge limited diode, and for the one-dimensional diode with finite field at the cathode plane are given. The results are compared with approximate solutions which are useful in different energy ranges. 5 Refs.

Primary Keywords: Space-charge-limited Diode; Electron Flow; Theory; 1-d Simulation; Relativistic Solution; Exact Solution

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8240
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)

HIGH-VOLTAGE PULSE GENERATOR IN THE NANOSECOND RANGE

V.M. Knyazev and V.A. Lyubimov

Institute of Theoretical and Experimental Physics, Moscow, USSR
Instruments and Experimental Techniques, Vol. 1, pp 85-88 (02/1969).
Trans. From: Priroby i Tekhnika Eksperimenta 1, 82-84
(January 1969)

The article describes a 26-stage generator of high-voltage pulses (g.v.p.) intended as a supply for a streamer-type flash camera operating with a 0.5-m gap. This g.v.p. produces pulses with a rise time of 0.1 nsec and a nominal amplitude of 1 MV. 4 Refs.

Primary Keywords: Pulse Generator; 1 MV Output Voltage; Compact Size; 16 ns Rise-time; 8 ns Fall Time

COPYRIGHT: 1969 PLENUM PRESS, REPRINTED WITH PERMISSION

8242
(SWITCHES, CLOSING; BREAKDOWN STUDIES)
(Gas Gaps, Materials; Electrodes)

INVESTIGATION OF THE NEAR-ELECTRODE REGIONS OF AN ARC DISCHARGE BETWEEN ELECTRODES OF DIFFERENT CHEMICAL COMPOSITION

I.F. Seliurovskaya, N.F. Tsygankov and N.K. Zaitsev
Journal of Applied Spectroscopy, Vol. 24, No. 2, pp 138-142 (02/1976).
Trans. From: Zhurnal Prikladnoi Spektroskopii 24, 208-213 (February 1976)

In arcs at atmospheric pressure, current transfer in the interelectrode gap is effected with the assistance of ionized atoms of the electrode material. Vaporization of the electrodes takes place by the mechanism of hot spots. As the temperature increases, sources of heat, if the cathode and anode have identical chemical compositions, then the predominant entry of the material of one or other electrode into the discharge gap is determined by the polarity of the electrode, i.e., by the characteristics of the current transfer at the electrode-plasma boundary. Therefore, by using dissimilar electrodes, a change of the rate of vaporization of the near-electrode region and, consequently, of the nature of striking of the electrode. This paper is devoted to a study of the dynamics of the near-electrode region, when materials with different properties are used as counterelectrodes. These investigations can be used, for example, when selecting a cycle of operation for difficult-to-replace electrodes (TMD generators) in facilities where the preferential vaporization of one of the electrodes is necessary (spot welding), etc. 9 Refs.

Primary Keywords: Gas Breakdown; Electrode Effects; Hot Spots; Polarity Effects; Similar Electrode Materials; Dissimilar Electrode Materials

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

8243
(PARTICLE BEAMS, ION)
(Generation)

METHOD OF GENERATING VERY INTENSE POSITIVE-ION BEAMS

J.M. Croadon, I.D. Smith and D.S. Grone

Physical International Co., San Leandro, CA 94577

Physical Review Letters, Vol. 35, No. 2, pp 91-94 (07/1975).
The combination of a reflex triode arrangement is analyzed. Under certain conditions it is possible to generate very intense beams of positive ions with this device. The analysis demonstrates that the energy loss and scattering of the electrons as they pass through the anode have a major effect on the ion and electron currents. Solid fractional-range anodes are shown to produce more intense ion beams than semitransparent mesh anodes. 8 Refs.

Primary Keywords: Reflex Triode; Analysis; Theory; Electron Reflection; Ion Flow; Foil Anode

COPYRIGHT: 1975 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8246
(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

MULTIPLE-SPARK OPERATION OF A MEGAVOLT TRIGATRON

A.S. El'chaninov, V.G. Emelyanov, V.M. Koval'chuk, G.A. Mesyats and Yu.F. Petalitsyn

Academy of Sciences of the USSR, Tomsk, USSR
Instruments and Experimental Techniques, Vol. 17, No. 2, pp 416-418
(04/1976)

Trans. From: Priroby i Tekhnika Eksperimenta 2, 103-105 (March-April 1976)

A megavolt gas-filled triatron having a spark ignition delay time $t_{\text{sub}} d = 5.1 \times 10^{-4}$ sec and double the range of working voltages is described. A dielectric bushing that projects above the plane of the main electrode is used in the firing section of the triatron. It is revealed that an optimal amplitude of the starting pulse exists for obtaining the minimal $t_{\text{sub}} d$. For parallel operation of two triatrons the commutation time was reduced almost by a factor of 2 for a discharged current of 26 kA. 2 Refs.

Primary Keywords: Triatron; Multichannel Operation; Multiple Triggers; 1 MV Operating Voltage; Subnanosecond Jitter

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

8245

(INSULATION, MAGNETIC)

()

NEGATIVE ION LOSSES IN MAGNETICALLY INSULATED VACUUM GAPS

J.P. VanDevender, R.W. Stinnett and R.J. Anderson

Sandia Labs, Albuquerque, NM 87115

Applied Physics Letters, Vol. 38, No. 4, pp 229-231 (02/1981).

Negative ion losses have been observed in long, self-magnetically insulated transmission line sections. The electrons are insulated. Time of flight spectra are constant with $H^{\text{sub}} - 1$, $H^{\text{sub}} - 2$, $H^{\text{sub}} - 3$, $H^{\text{sub}} - 4$, and heavier molecular ions with energies corresponding to the full anode-cathode potential difference. The negative ion current density J_{sub} / l is a sensitive function of the conditions under which the cathode plasma is produced. 11 Refs.

Primary Keywords: Magnetic Insulation; Ion Lasers; Cathode Plasma; Loss Reduction

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8246

(PARTICLE BEAMS, ELECTRON)

(Generation)

PRODUCTION OF ANNULAR ELECTRON BEAMS BY FOILLESS DIODES

R.B. Miller, K.K. Prestwich, J.W. Poukey and S.L. Shope

Sandia Labs, Albuquerque, NM 87115

Journal of Applied Physics, Vol. 51, No. 7, pp 3586-3515 (07/1980).

A number of important aspects of the production of annular electron beams by foilless diodes are examined, both theoretically and experimentally. The theories of Ott, Antonsen, and Lovelace (OAL) and Chen and Lovelace (CL) are compared, and the CL theory is extended to include the effect of an axial gap in an approximate fashion. For the case of finite magnetic field strengths, Larmor orbits are examined and radial oscillations of the beam profile are predicted from a beam envelope analysis. Experimental results obtained with both low- and high-impedance sources have been compared with the theory, and based on such studies, the design and construction of an intense hollow beam generator are described. Experimental results obtained with the new diode compare favorably with both the analytic theory and the results of numerical simulations. The device currently produces 2-MeV electrons at beam currents of 65-70 kA. 18 Refs.

Primary Keywords: Field Emission Diode; Foilless Diode; Annular Beam; Beam Oscillation; Comparison With Theory; 2 MeV Beam Energy

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8247

(PARTICLE BEAMS, ION)

(Generation)

PRODUCTION OF 0.5-TW PROTON PULSES WITH A SPHERICAL FOCUSING,

MAGNETICALLY INSULATED DIODE

D.J. Johnson, G.W. Kuade, A.V. Farnsworth Jr., J.P. Quintenz, R.J. Leaper, E.J.T. Burns and S. Humphries Jr.

Sandia Labs, Albuquerque, NM 87115

Physical Review Letters, Vol. 42, No. 9, pp 619-623 (02/1979).

The production, focusing, and numerical simulation of a 0.5-TW proton beam is reported. This beam is produced with a spherical, magnetically insulated, ion diode fed symmetrically by the direct-current-line proton gun generator. The ions are accelerated with electric fields due to a virtual cathode supported by magnetic field surfaces. Approximately 75% of the diode electrical power is delivered to ions and 25% of the ion beam is focused upon thin, 1-cm-diam, 1-cm-long conical targets to produce the first experimental ion-driven implosions. 10 Refs.

Primary Keywords: Proton Beam; Virtual Cathode; High Efficiency; Contoured Magnetic Field; Experiment; Theory; Numerical Calculation

COPYRIGHT: 1979 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8248

(PARTICLE BEAMS, ELECTRON)

(Generation)

RELATIVISTIC PLANAR DIODE IN A MAGNETIC FIELD

E.M. Hahnem, La Jolla, CA 92038

Applied Physics Letters, Vol. 39, No. 5, pp 447-449 (05/1981).

The exact steady-state solution for the planar relativistic diode in space-charge-limited conditions is given in the presence of magnetic fluxes below magnetic insulation. It is shown that, as in the classical case, at fixed diode voltage, the value of the current density reaching the anode goes discontinuously from a finite value to zero as a function of the magnetic flux at the magnetic insulation cut-off point. The limiting current density just below cutoff is given as a function of voltage and gap distance. This steady-state one-dimensional result below and very near the magnetic insulation threshold is in contradiction with experimental observations. 11 Refs.

Primary Keywords: Planar Diode; Space-charge-limited Operation; Transverse Magnetic Field; Magnetic Insulation; Cutoff Field; Theory; Comparison With Experiment

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

203

8249
(REVIEWS AND CONFERENCES)

(Reviews) MILLIMICROSECOND PULSE TECHNIQUES (SECOND EDITION)
I.A.D. Lewis (1) and F.H. Wells (2)
(1) Royal Radar Establishment, Malvern, Worcestershire, UK
(2) Atomic Energy Research Establishment, Harwell, Berkshire, UK
Publisher: Pergamon Press (01/1959).

'Millimicrosecond Pulse Techniques,' though somewhat dated, contains a wealth of material concerning basic pulse generation and diagnostic techniques. The book contains chapters on lossless and lossy transmission line analysis; pulse generators; pulse transformers and transmission lines; pulse amplifiers; and cathode ray oscilloscopes. In addition, chapters on practical aspects of using pulsed power techniques in nuclear physics are included. Many practical applications are given. Detailed mathematical analyses are included. 711 Refs.

Primary Keywords: Transmission Lines; Pulse Transformer; Pulse Generator; Pulse Amplifier; Pulse Diagnostics; Voltage Divider; Analysis; Application

COPYRIGHT: 1959 PERGAMON PRESS

8250
(PARTICLE BEAMS, ELECTRON)
(Generation)

THEORY OF FOIL-LESS DIODE GENERATION OF INTENSE RELATIVISTIC ELECTRON BEAMS
E. Ott, T.M. Antonson Jr. and R.V. Lovelace
Cornell University, Ithica, NY 14850

The Physics Of Fluids, Vol. 20, No. 7, pp 1180-1184 (07/1977).

A study is made of the generation of intense hollow relativistic electron beams in a foilless diode. A strong magnetic field is assumed so that the electron motion is one dimensional. Also, the electron motion is considered to be ultra-relativistic. The problem of the self-consistent space charge in the diode is reduced to a singular integral equation. This integral equation is solved and the nature of the solutions is discussed. The beam density increases at the beam edges and has a minimum in the beam interior. The diode impedance as a function of the beam thickness and geometry is discussed. 19 Refs.

Primary Keywords: Field Emission Diode; Foilless Diode; Strong Axial Magnetic Field; 1-d Electron Flow; Space Charge;

Copyright
COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8252
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)
(Marx; Marx Generators)

ARKAD'EV-MARX GENERATOR IN A CONDUCTING SHIELD

I.M. Roife, E.V. Seredenko and B.A. Stekol'nikov
Scientific-Research Institute Of Electro-Physical Equipment, Leningrad,
USSR

Instruments And Experimental Techniques, Vol. 14, No. 6, pp 1681-1683
(12/1971).

Trans. From: Pribyly i Tekhnika Ekspеримента 6, 87-88
(November-December 1971).

Results are presented of an investigation of a pulse-voltage generator which is designed to operate in a tank filled with N₂/sub 2/ under pressure and differs from well-known pulse-voltage generator networks for the nanosecond range in that the high-voltage pulse shaping is achieved under conditions of a noticeable influence of the tank. 3 Refs.

Primary Keywords: Marx Generator; Pulse Shaping; Interaction With Container; Delay Measurement; Spark Gap

COPYRIGHT: 1972 PLENUM PRESS, REPRINTED WITH PERMISSION

8254
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Gas Gaps; Materials)
CONSUMPTION AND DEGREE OF USE OF ELECTRODE MATERIAL IN A HIGH-FREQUENCY CONDENSED SPARK DISCHARGE

G.G. Barvinko, A.M. Borbat and A.S. Dom'yanchuk
Journal Of Applied Spectroscopy, Vol. 2, No. 2, pp 117-118 (12/1966).

Trans. From: Zhurnal Prikladnoi Spektroskopii 7, 163-165 (1967).
Electrode consumption becomes of primary importance in the analysis of thin wires, finished components, etc. The degree of use of the material is also important. We have examined the consumption rate and degree of use of the material in a high-frequency condensed spark discharge. 7 Refs.

Primary Keywords: Electrode Erosion; AC Arc; Condensed Spark; High-frequency Condensed Spark

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

8256
(BREAKDOWN STUDIES)

(Electrodes) DYNAMICS OF ELECTRODE SPOTS IN AN ELECTRIC ARC

A.V. Brichkin, A.V. Bolotov and T.V. Boriakova
Soviet Physics-Technical Physics, Vol. 11, No. 7, pp 929-934 (08/1967).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 1251-1258 (July 1966).

The mechanisms of expansion and movement of the cathode and anode spots in a DC arc is considered in relation to the thermal state and emissive properties of the electrode. The experimental technique used to investigate a moving arc and the nature of the operation of copper electrodes is described. A plot of the current density in the electrode spots of arcs on copper electrodes against the electrode temperature is given. 11 Refs.

Primary Keywords: DC Breakdown; Cathode Spots; Temperature Measurement; Copper Electrodes; Spot Movement;

Position

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8257
(BREAKDOWN STUDIES)

(Gas, Electrical)

EFFECT OF CORONA CHARGE ON THE FORMATION OF A LONG POSITIVE SPARK UNDER THE ACTION OF A VOLTAGE PULSE

E.M. Bezelyan

Soviet Physics-Technical Physics, Vol. 11, No. 2, pp 267-272 (08/1966).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 36, 365-373 (February 1966).

The formation of a long positive spark is accompanied by injection of a certain portion of the space charge into the spark gap; this results in distortion of the initial field distribution at the electrodes and affects the subsequent development of the discharge. This is true in particular of the charge in a corona pulse which forms at the beginning of the discharge and is capable of affecting the subsequent stages of the spark. In the first part of this work it has been shown that the distortion of the field by the corona charge pulse is a considerable one and that it should be taken into account when investigating gas discharge processes. The results of an experimental evaluation of the effect of a corona pulse on the subsequent formation of a long positive spark are presented here. 4 Refs.

Primary Keywords: Long Discharge; Corona; Field Distortion By Space Charge; Discharge Development

COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8260
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

HIGH-VOLTAGE PULSE MEASUREMENT WITH A PRECISION CAPACITIVE VOLTAGE DIVIDER

M.F. Brady and K.G. Dadrick

Stanford University, Stanford, CA 94305

The Review Of Scientific Instruments, Vol. 33, No. 12, pp 1421-1428
(12/1962).

The capacitive voltage divider can be designed to have an accurately known division ratio over a wide range of operating frequencies. A coaxial, guardring type geometry is described, and an analysis of possible errors due to geometrical anomalies and temperature variations is given. Due to the particular method of construction used, the division ratio of the divider itself is essentially independent of the dielectric constant of the dielectric oil used. Bridge circuits and their pertinent equations for calibrating the divider are presented. An experimental divider designed to operate on pulsed voltages up to 350 kV is described, having an over-all division ratio of 1042.3 for 6.0 with an expected temperature dependence of 0.01%/Deg.C. 11 Refs.

Primary Keywords: Capacitive Divider; Coaxial Geometry; Guard Ring; Theory

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8262
(BREAKDOWN STUDIES)

(Gas, Electrical)

LONG HIGH-PRESSURE ARCS

E.S. Borovik, R.V. Mitin and Yu.R. Knyazev

Soviet Physics-Technical Physics, Vol. 6, No. 11, pp 968-973 (05/1962).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 1329-1333 (November 1961). An apparatus for the production of long arcs (up to 8 cm long) at pressures of several tens of atmospheres is described. The arc is stabilized by rotation of the gas surrounding the arc. The plasma temperature, calculated with the aid of the equations for the electrical conductivity of the plasma and the energy balance in the arc column, was 2.2E Deg.K. for a power consumption of 2E5 W/cm.
10 Refs.

Primary Keywords: Long Arc; High-pressure Arc; Stabilized Arc; Surrounding Gas Rotation; Energy Balance; Pinching

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8264
(BREAKDOWN STUDIES)

(Gas, Electrical)

MEASUREMENT OF IONIZATION AND ATTACHMENT COEFFICIENTS IN SULPHUR HEXAFLUORIDE IN UNIFORM FIELDS

M.S. Bhella and J.D. Clegg

University of Liverpool, Liverpool, UK

Proceedings Of The Physical Society, Vol. 80, pp 151-160 (07/1962).

The growth of pre-breakdown currents in uniform field conditions in sulphur hexafluoride at different pressures for values of E/P in the range of 90 to 160 V/Torr-cm (5-200 mbar pressure) indicated very large electron attachment. It is assumed that the mechanism of negative ion formation is due to associative attachment; therefore values of the dimensionally equivalent attachment coefficient etc have been computed from the semi-logarithmic plots of current against electrode separation by employing the modified Townsend equation for the growth of current. Further, static breakdown potentials have been measured up to a value of pd (pressure x gap length) approximately 400 mmHg cm, and a comparison with the data for dry air gives the relative dielectric strength of SF₆/sub 6/ as about 2.8 at 380 mmHg cm. 19 Refs.

Primary Keywords: Ionization Coefficient; Attachment Coefficient; SF₆/sub 6/ Gas; Current Measurement; Comparison With Air

COPYRIGHT: 1962 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8265
(BREAKDOWN STUDIES)

(Vacuum, Particles)

MICROPARTICLE-INITIATED VACUUM BREAKDOWN-SOME POSSIBLE MECHANISMS

M.M. Manoh and K.D. Srivastava

University of Waterloo, Waterloo, Ontario, Canada

Journal Of Applied Physics, Vol. 45, No. 9, pp 3832-3836 (09/1974).

It is known that micron- and submicron-sized metallic particles are released from the electrode surfaces when a vacuum gap is subjected to a high DC stress. It is also well known that larger particles (>10 micron) are generated within the interelectrode gap when a vacuum gap is subjected to conditioning or severe overbreakdown current. In this paper, examination is made of such particles in initiating the breakdown of a vacuum gap. While the larger particles induce breakdown by way of a trigger discharge, it is shown that the smaller particles can initiate breakdown because of effects associated with impact. The various effects associated with the high speed impact of a metallic microparticle on a target electrode, viz., cratering, production of metal vapor, and production of thermally generated plasma and their relative significance on vacuum breakdown, are examined. 11 Refs.

Primary Keywords: Particle Initiated Breakdown; Electrode Particle Source; DC Voltage; Prebreakdown Current; Discharge Initiation Mechanism

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

826

(BREAKDOWN STUDIES)
(Gas; E-beam)NEGATIVE ION FORMATION AND ELECTRIC BREAKDOWN IN SOME HALOGENATED GASES
H.M. Hickam and D. Berg

Westinghouse Research and Development Center, Pittsburgh, PA

The Journal of Chemical Physics, Volume 29, No. 3, pp 517-523 (09/1958).

Utilizing a conventional electron gun and mass spectrometer, the formation of negative ions at low electron energies have been investigated for a number of halogen containing gases used in electric breakdown studies. The SF₆/peak ~ peak is used as an energy calibration for establishing the appearance potential and the energy width over which capture occurs for the individual gases. It is found that the relative areas of the negative ion curves can be correlated with the electric strength of the gases. These results suggest that the formation of SF₆/peak ~ peak may be the important process in providing the relatively high electrical strength of SF₆/peak ~ peak. Electron attachment associated with SF₆/peak ~ peak and Cl₂/peak ~ peak is found to be an extremely sensitive function of the gas temperature. The gases investigated include Cl₂/peak ~ peak, Cl₂/peak ~ peak, Cl₂/peak ~ peak, ClClF/peak ~ peak, CF₄/peak ~ peak, CF₄/peak ~ peak, SF₆/peak ~ peak, F₂/peak ~ peak, ClO₂/peak ~ peak, and ClO₂/peak ~ peak. 12 Refs.

Primary Keywords: Negative Ion Formation; E-beam Electron Supply; Electron Capture Energy Range; Correlation With Breakdown Voltage

COPYRIGHT: 1958 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

826

(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Electrodes; Vacuum Gaps; Materials)

PLASMA EXPANSION AS A CAUSE OF METAL DISPLACEMENT IN VACUUM-ARC CATHODE SPOTS

G.W. McClure

Sandia Labs, Albuquerque, NM 87115

The pressure on the molten surface of a vacuum-arc cathode due to the recoil from outward-directed ion jets is calculated for copper arcs. The calculation uses current density data and electrode force per unit current data from experiment. In addition, the force per unit current measured by Tanberg is shown to be consistent with a calculation of the same quantity based on the energy of outgoing ion, measured by Davis and Miller, and the so-called saturated positivization current measured by Kimblin. The ion recoil pressure is shown to be sufficient to remove molten metal from a cathode-spot crater in time of the order of 25-254 nsec with a velocity of 2E3-2E4 cm/sec. It is shown that motion of molten metal in the cathode-spot crater must be considered as a first-order effect in rigorous calculations of surface temperature and jet flow in the metal in contact with the cathode-spot plasma. It is suggested that the rapid removal of metal by the plasma pressure causes molten droplets to be ejected, as has been observed experimentally, and causes a preference for the cathode to operate, after the liquid is ejected, on the rim of the crater or nearby on the surface where hotter metal may exist due to liquid-metal overflow and spatter. 35 Refs.

Primary Keywords: Vacuum Arc; Cathode Spots; Copper Electrodes; Ion Jet; Ion Recoil; Metal Droplets

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

827

(DIAGNOSTICS AND INSTRUMENTATION)
(Current)

ROGOVSKI LOOP FOR MEASUREMENT OF CURRENTS OF NANOSECOND DURATION

A.M. Stefanovskii

GKAE Atomic Energy Institute, Moscow, USSR

Instruments And Experimental Techniques, No. 2, pp 375-378 (04/1967).

Trans. From: Pribory i Tekhnika Experimenta 2, 149-152 (March-April 1967).

A Rogowski loop for the measurement of pulsed currents of nanosecond duration is considered on the basis of a formula which gives the frequency response of the loop and the magnitude of spurious signals associated with external fields. Constructional and electrical data are cited for loops which have been employed to study the acceleration of plasma electrons in toroidal systems. 5 Refs.

Primary Keywords: Rogowski Coil; Analysis; Frequency Response;

Response To External Fields; Analytical Formula

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

827

(DIAGNOSTICS AND INSTRUMENTATION)
(Current)

ROGOVSKI COILS: THEORY AND EXPERIMENTAL RESULTS

V. Nessi and A. Lucchesi

Università di Lecce, Lecce, Italy

The Review of Scientific Instruments, Vol. 50, No. 7, pp 900-902 (07/1979).

The theory is given of the voltage output of a Rogowski coil excited by a current pulse flowing along the axis of the coil. In this theory the Rogowski coil is considered as a delay line. The results do not differ from those obtained by considering the coil as a voltage source with an inductive output impedance. Details are also given of the design of two Rogowski coils and their working modes are fully analyzed. 5 Refs.

Primary Keywords: Rogowski Coil; Delay Line Model; Design Considerations; Magnetic Shield; Performance Test

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

827

(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Gas; Electrical; Gas)

SOME MEASUREMENTS OF THE RELATIVE DIELECTRIC STRENGTH OF GASES

H.R. McCormick and J.D. Craggs

University of Liverpool, Liverpool, UK

British Journal of Applied Physics, Vol. 5, pp 171-173 (05/1954).

Measurements of the breakdown voltages of small sphere gaps in various gases have been made mainly to check existing results but also to provide new data. Various electro-negative gases, such as SF₆/peak ~ peak, Cl₂/peak ~ peak, etc., were studied, taking nitrogen as a standard gas, and the data are tabulated. A brief discussion of these results is given. 18 Refs.

Primary Keywords: Gas Breakdown; Several Gases; Breakdown Voltage; Nitrogen Gas; Electronegative Gases; Hydrogen; Chlorine; Variable Gap Spacing

COPYRIGHT: 1954 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

827

(BREAKDOWN STUDIES)
(Gas, Electrical)

STATISTICAL TIME LAGS IN GAS DISCHARGE GAPS IRRADIATED WITH A RADIOACTIVE MATERIAL

D.T.A. Blair and O. Ferish

University of Strathclyde, Glasgow, Scotland

British Journal of Applied Physics, Vol. 18, pp 597-604 (05/1967).

Theoretical values of mean statistical time lag have been estimated for concentrations of up to 5% for a uniform field discharge gap of 2 cm length in nitrogen at 400 Torr and 28 Deg.C. with 2 mCi of cobalt 60 located in the cathode. The results are in reasonable agreement with measured value, and indicate that in order to render the mean statistical time lag negligible in comparison with the formative time lag under these conditions it would be necessary to increase the strength of the radioactive source to about 30 mCi. When the source is located in the anode it is not possible to estimate reliable theoretical values because of the difficulty of making reasonable simplifying assumptions regarding the distribution of initial ionization close to the cathode surface: the measured values do not differ by a factor of more than two from those obtained with the source in the cathode. 12 Refs.

Primary Keywords: Nitrogen Breakdown; Statistical Time Lags; Uniform Field; SF₆ Overvoltage; Cobalt 60; Theory

COPYRIGHT: 1967 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

827

(BREAKDOWN STUDIES)
(Gas, Electrical)

TEMPERATURE DETERMINATION FOR ARCS IN SULPHUR HEXAFLUORIDE ACCOUNTING FOR DEMIXING

E. Schulz-Gude

Institut für Plasmaphysik, Garching, FRG

Journal of Physics D: Applied Physics, Vol. 13, No. 5, pp 793-803 (05/1980).

Methods of temperature determination for arcs in sulphur hexafluoride (SF₆/peak ~ peak) are presented for the temperature range from 9000 to 20000 Deg.K. Temperatures are derived from combinations of measured S I, S II, S III and F I and F II absolute line intensities and computed equilibrium plasma composition data by means of iterative procedures. Demixing effects are accounted for as both the temperature and the fluorine to sulphur concentration ratio M are determined from the measured data. The methods are applied to experimental line intensity data obtained from steady-state wall-stabilized arcs in SF₆/peak ~ peak at atmospheric pressure, at axis temperatures of about 15000 K. Simple approximation formulae are given for calculating the various partition functions at a pressure of p=1 bar for M=6, 12, 24 and 48; and at p=2, 4, 8 and 16 bar for M=6, 25 Refs.

Primary Keywords: SF₆/peak ~ peak; Breakdown; Temperature Measurement; Spectroscopic Observations; Demixing Effects; 1-16 Bar Pressure Range; Approximate Temperature Formula

COPYRIGHT: 1980 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

827

(SWITCHES; CLOSING)

(Avalanche Transistors, Electrical)

THE APPLICATION OF AVALANCHE TRIGODES IN NUCLEAR-ELECTRONICS CIRCUITS

L.E. Gavrilov

Moscow Engineering-Physics Institute, Moscow, USSR

Instruments And Experimental Techniques, Vol. 16, No. 6, pp 1615-1627 (12/1973).

Trans. From: Pribory i Tekhnika Experimenta 6, 5-17 (November-December 1973)

The physical foundations of the operation of avalanche transistors are considered along with their distinguishing features, possibilities, and the most promising fields for their application. Characteristics are given of Soviet and foreign avalanche transistors, as well as practical recommendations for the use of low-power transistors operating in the avalanche mode which are manufactured by industry. The main attention is devoted to circuits for the generation and shaping of pulses having nanosecond lengths, including rectangular and triangular-pulse generators, staircases, and sawtooth voltage generators, powerful voltage and current pulse generators, etc. Circuits for amplitude and time selection of pulses are given which are designed using avalanche triodes, as well as counting circuits. 90 Refs.

Primary Keywords: Avalanche Transistor; Characterization; Application; Pulse Shaping; Pulse Generation; Nanosecond Pulses

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

827

(SWITCHES; CLOSING; SWITCHES; CLOSING)

(Gas Gaps; Electrical; Gas Gaps; Thermal)

THE BREAKDOWN MECHANISM OF CERTAIN TRIGGERED SPARK GAPS

T.E. Freedman

University of Manchester, Manchester, UK

British Journal of Applied Physics, Vol. 8, pp 37-40 (01/1957).

Experiments designed to investigate the breakdown mechanisms of certain triggered spark gaps in air are described. Possible theories of the breakdown mechanism of the triatron and the thermally triggered spark gap are put forward, based on experimental voltage and time lag to breakdown characteristics, corona measurements, and on optical studies using a photomultiplier. It is shown that the mechanism of breakdown for the two forms of triggered spark gap may be similar and depend, with positive charging polarities, on the movement of positive ions followed by a streamer process, and, in the case of negative charging polarities, on a streamer process only. 9 Refs.

Primary Keywords: Spark Gap; Air Gap; Triatotron; Thermally Triggered Spark Gap; Breakdown Mechanism; Streamer; Experiment; Theory

COPYRIGHT: 1957 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

205

8279

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Liquid Gaps; Materials)

THE MECHANISM OF ELECTRICAL EROSION OF METALS IN LIQUID DIELECTRIC MEDIA

B.N. Zolotykh

Soviet Physics-Technical Physics, Vol. 4, No. 12, pp 1370-1373 (1961-1960).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 29, 1484-1486 (December 1959)
 The nature of the forces responsible for the ejection of metal from craters created on the surface of electrodes under the effect of impulse discharge is not yet completely known. High-speed photography of the erosion process has made it possible to obtain new information concerning these forces. He photographed the erosion process resulting from single discharge in kerosene lasting 180 microseconds. He used a pulsed current impulse: the value of the maximum current was 1000 amperes, the spark gap was 30 microns; the value of maximum voltage was 200 volts, the energy of the impulse was 2.5 joules. The anode was a copper plate 0.1 mm thick; the cathode was a copper wire 1 mm in diameter; the electrodes were placed at an angle of 90° to each other. 3 Refs.

Primary Keywords: Electrode Erosion; Kerosene Gap; Impulse Voltage; Photographic Diagnostic; 1000 A Current; Point-plane Gap.

COPYRIGHT: AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8280

(BREAKDOWN STUDIES)

(Electrodes)

THE VAPORIZATION OF THE CATHODE IN THE ELECTRIC ARC

R. Holm, Stackpole Carbon Co., St. Marys, PA

Journal Of Applied Physics, Vol. 20, No. 7, pp 715-716 (07/1949).
 Calculations are carried out which show that, because of the smallness of the electrode spot, the cathode is not able to dissipate the heat generated with heavy currents by conduction. Therefore, a much higher vaporization of cathode material per coulomb occurs for heavy currents than for low currents. 9 Refs.

Primary Keywords: Electrode Erosion; Cathode Spot; Metal Vaporization; Low Current; High Current; Comparison; Theory; Energy Balance.

COPYRIGHT: 1949 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8281

(BREAKDOWN STUDIES)

(Gas, Electrical)

TIME-RESOLVED RADIAL TEMPERATURE PROFILES FOR 10 KA SF/SUB 6/ ARCS

D.R. Airey, P.H. Richards and J.D. Swift

Marchwood Engineering Lab., Southampton, UK

Journal Of Physics D: Applied Physics, Vol. 8, No. 16, pp 1982-1993 (11/1975).

Radial temperature profiles for pulsed SF₆/arcs burning in high-pressure, approximately 5 bar, supersonic gas flow have been measured for discrete current levels in the range 10 kA-1.0 kA. The current pulse was a 10.6 ms half-sine wave and all the temperature measurements were carried out as the current decayed from 10 kA towards zero. The temperature distribution was obtained by comparing the calculated and measured emission intensities of spectral lines due to excited fluorine and ionized sulphur in local thermodynamic equilibrium. No evidence has been found for the sulphur/fluorine density ratio effect previously reported in a study of discharging cascade arcs, but strong column instabilities have been observed. The temperature profiles were measured for times when the arc exhibited reasonable radial symmetry. The results for currents above 3.5 kA show that the axis temperature is 20000 Deg.K for 1000 Deg.K and is independent of the arc current. Also, the temperature profile is essentially parabolic, and any increase in arc current is accompanied by a corresponding increase in arc cross section to maintain a constant current density. Below 3.5 kA the axis temperature falls rapidly with current down to 15500 Deg.K for 1000 Deg.K and the temperature profiles show very steep temperature gradients less than 1 m from the arc axis. 22 Refs.

Primary Keywords: SF₆/ Breakdown; Radial Temperature Profile; 5 Bar Pressure; Supersonic Gas Flow; 1-10 kA Current Range.

COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8282

(BREAKDOWN STUDIES)

(Gas, Electrical)

TIME-RESOLVED SPECTROSCOPY OF SPARK DISCHARGES

F. Tsui, University of Liverpool, Liverpool, UK

British Journal Of Applied Physics, Vol. 3, pp 139-140 (05/1952).

Using a rotating-mirror and a spectrometer, the spectra of the light emission from spark discharges in several gases have been photographed at different instants after the current-initiation. By triggering the discharge recurrently in synchronism with the mirror, the time-resolved spectral images of a number of sparks were superposed to obtain sufficient blackening on the photographic plate. The triggering circuit was activated by the rotating-mirror, and, when provided with a counter, the system could be left in automatic operation. 1 Refs.

Primary Keywords: Spark Discharge; Spectroscopy; Rotating Mirror; Strobe Camera; Several Frames; Image Averaging; Several Gases; Tungsten Electrodes; Point-point Gap; 200 A Current Range.

COPYRIGHT: 1952 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8283

(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Electrodes; Gas Gaps; Materials)

VAPORIZATION OF METAL ELECTRODES BY PULSED CURRENTS

G.S. Belkin

Moscow Power Institute, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 13, No. 9, pp 1256-1260 (03/1969).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 38, 1545-1551 (September 1968)

Experiments have shown that the mass of metal vaporized from a copper cathode at currents less than 40 kA in helium at a pressure of 1 atm is proportional to the charge and is given by $M/\text{sub v} = (0.6 \pm 1.2) \times 10^{-5} \text{ g/C}$. In this case the anode loss is many times smaller than the cathode loss. The constancy of $M/\text{sub v}$ for large current variations is explained by the fact that vaporization of a copper cathode occurs at individual spots of current less than 40 kA. At currents greater than 150 kA, the ratio of the mass of vaporized metal to the integral of $i \cdot dt$ can be 30-60 times greater than $M/\text{sub v}$ for a copper cathode at currents smaller than 40 kA. At high currents vaporization occurs not only from cathode spots, but from the entire surface of the electrode covered by the spots. For this reason a marked increase in the mass of vaporized metal is possible at currents above 150 kA. Calculation of the mass of vaporized metal, averaging the thermal flux over the area of the electrode covered by spots (allowing for the increase in path cross section by the end of the discharge), gave a value of 26 mg for a current of 500 kA with a period of 140 microseconds and a damping factor of 8.7E3/sec; the experiment gives 32 mg. 11 Refs.

Primary Keywords: Electrode Erosion; Copper Cathode; Helium Gas; Atmospheric Pressure; 150 kA Current; Dependence On Large Transfer; Cathode Spot.

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8284

(BREAKDOWN STUDIES)

(Gas, Electrical)

VOLTAGE-TIME CHARACTERISTIC OF ELECTRICAL BREAKDOWN IN SF/SUB 6/

T. Hotta, Y. Shibuya and Y. Fujiwara

Mitsubishi Electric Corp., Amagasaki, Japan

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-94, No. 1, pp 108-115 (02/1975).

V-t characteristic of impulse and switching surge breakdown in SF₆/SF₆/ is studied on various gaps. The characteristic is categorized into three patterns depending on the configuration of the gap and gas pressure. The properties of the V-t characteristic in these patterns are generalized as a semi-empirical formula which will be useful in the quantitative evaluation of the insulation coordination and the abnormal voltage protection of SF₆/gas insulated power equipment. The gap conditions in which these patterns of V-t characteristic are observed are also discussed in the Appendices. 15 Refs.

Primary Keywords: SF₆/ Breakdown; Voltage Measurement; Semi-empirical Formula; Sphere-Sphere Gap; Corona Stabilization.

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

8285

(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

WIDEBAND HIGH VOLTAGE PROBE

R. Keller

Laboratoire Recherches sur la Physique Des Plasmas, Lausanne, Switzerland

Review Of Scientific Instruments, Vol. 35, No. 8, pp 1057-1060 (08/1964).

A high voltage probe is described which is based on the principle of consecutive differentiation and integration. The voltage to be measured is applied to a coupling capacitor of a few picofarad and related at several tens of kilovolts. The capacitor is connected to a cable which propagates a signal proportional to the derivative of the voltage. At the other end of the cable a transistorized integrator integrates the current and produces a signal proportional to the voltage. It is thus possible to obtain a bandwidth of 300 Hz to 200 MHz. 6 Refs.

Primary Keywords: Differentiating Probe; Integrating Sensor; 70 kV Operating Voltage; 200 MHz Bandwidth.

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8286

(BREAKDOWN STUDIES)

(Gas, Electrical)

CATHODE SPOTS IN THE TRANSIENT GLOW DISCHARGE IN NITROGEN

D. Farish and D.J. Tadford

University of Strathclyde, Glasgow, Scotland

British Journal Of Applied Physics, Vol. 17, pp 965-966 (07/1966).

Cathode spots, arranged in a regular pattern of concentric circles, have been observed to occur during the transient glow discharge stage of the impulse breakdown of uniform field gaps in nitrogen. 3 Refs.

Primary Keywords: Glow Discharge; Nitrogen Discharge; Cathode Spot; Spot Pattern; Copper Electrodes; Nickel Plating.

COPYRIGHT: 1966 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8287

(REVIEWS AND CONFERENCES; INSULATION, MATERIAL)

(Reviews)

INSULATING MATERIALS FOR DESIGN AND ENGINEERING PRACTICE

F.M. Clark

General Electric Co., Schenectady, NY 12301

Publisher: John Wiley And Sons, Inc., New York (01/1962).

Mr. Clark has produced a very thorough treatise on insulation in this book. The book begins with a short review of the purpose of insulation and some of the constraints and proceeds to consider in depth several of the important aspects of insulating systems' design and maintenance. The book includes chapters on insulating material selection, writing specifications, long-term temperature and environmental effects, and manufacture and maintenance. Complete characterization of many gaseous, liquid, solid, and composite insulation systems are very important part of the book. Breakdown mechanisms are discussed. Pulsed voltages are not considered extensively. 1709 Refs.

Primary Keywords: Material Insulation; Review; Insulation Selection; Insulation Maintenance; Environmental Effects; Insulation Characterization; Gaseous Insulation; Liquid Insulation; Solid Insulation; Insulation Systems.

COPYRIGHT: 1962 JOHN WILEY AND SONS, INC., NEW YORK

8288
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Liquid, Electrical; Ignitrons, Materials)
FIELD ELECTRON EMISSION FROM LIQUID MERCURY

J. W. Beams
University of Virginia, VA
Physical Review, Volume 44, pp 803-807 (11/1933).

Field emission from liquid mercury has been investigated by applying an impulsive potential of approximately 10^{-6} sec. duration between a spherical steel anode and a plane mercury cathode. The field just necessary to produce breakdown gave a measure of the field necessary to produce emission because rotating mirror photographs showed that the field emission from the cathode initiated the discharge. The liquid mercury cathode was cooled to a few degrees above its freezing point and the mercury vapor pressure still further reduced by solid CO₂ subl₂ traps. The mercury could be distilled repeatedly in vacuo and the surface of the cathode changed by "levitation". The electric field necessary to produce sufficient field emission to start the discharge depended upon the purity of the mercury surface. It varied from 3.5E6 volts per cm for impure mercury to 1.8E6 volts per cm for mercury that had been repeatedly distilled in vacuo. 17 Refs.

Primary Keywords: Field Emission; Mercury Surface; Spherical Anode; Steel Anode; Variable Purity

COPYRIGHT: 1933 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8289
(BREAKDOWN STUDIES)
(Liquid, Electrical)

A THEORY OF LIQUID SURFACE RUPTURE BY A UNIFORM ELECTRIC FIELD

1. Tonks
General Electric Co., Schenectady, NY 12301

Physical Review, Vol. 58, pp 562-568 (09/1935).

Surface distortion and rupture limits of field emission from liquid surfaces at field strengths less than those effective for equally smooth solid surfaces. An approximate mathematical theory of the rupture of a plane liquid surface in a uniform electric field has been developed. The relation between initial distortion, rupture time, and field strength has been calculated for fields which are large when compared to that which just renders the surface unstable. Typically, the theory shows that a hump initially 4E-5 cm high and of diameter 9E-5 cm will lead to rupture in 5E-6 sec. in a field of 1E6 V/cm. Relative to initial humps in the surface whose linear dimensions vary inversely as the square of the field, the time to rupture varies inversely as the cube of the field strength. This calculation shows that a lowered sparking potential to liquid mercury can be ascribed to surface rupture and shows that it is possible that surface rupture plays a part in Beams low field emission from liquid mercury. Possible application of this theory to the field emission condition at the cathode spot of the H. Arc is not clear. 4 Refs.

Primary Keywords: Liquid Surface Distortion; Surface Rupture; E-field

COPYRIGHT: 1935 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8292
ADVANCED CONCEPTS FOR PHOTON SOURCES: VOLUME 2. FAST SWITCHING OF VACUUM MAGNETIC ENERGY STORES

V. Bailey, L. Dwyer, J. Benford, A. Koeth and D. Sloan

Physic International Co., San Leandro, CA 94577

Final rept. Sep 72-Jul 73 No. PIFR-398-Vol-2, 228p (10/1973).

Availability: AD-A015 386/6ST

NTIS

Inductive (magnetic) energy storage systems are analyzed in terms of their application to generation of ultra-high power pulses. Such systems can transform low-power energy inputs into high-power outputs (power multiplication) by shortening the energy delivery time. Energy transfer from magnetic store to resistive load can approach 100 percent efficiency. Models of several accelerated rotating plasma transfer switch geometries indicate that such switches can be magnetically efficient and can produce substantial voltage multiplications. Using a versatile and extensively diagnosed apparatus, experiments were conducted to test these predictions. The experiments confirmed the modeling and established design criteria for metallic wire plasma switches. Operating at 25 kJ energy level, a coaxial switch produced narrow (60 to 300 nsec) voltage spikes with voltage and power multiplicities of 3.

Primary Keywords: Energy Storage; Power Supplies; Pulse Generators; Magnetic Cores; Vacuum; Toroids; Switching Circuits; Plasma Devices

Secondary Keywords: Inductive Energy Storage; Magnetic Energy Storage; NTISDOOD

8297
(ENERGY STORAGE, CAPACITIVE)

(Capacitors)

ADVANCED SIMULATION RESEARCH: VOLUME III. VACUUM ENERGY STORAGE

H. Clark, F. Kern, A. Mondelli, and N. Rostoker

Maxwell Labs. Inc., San Diego, CA 92123

Final rept. 1 Aug 74-31 Jul 75 No. MLR-498. 150p (09/1975).

Availability: AD-A048 158-0ST

NTIS

The STP experiment has been placed in operation during this contract period. A number of electron injectors have been expired with the injected charge shown to scale linearly with the injector bias voltage. Injected charge levels are approximately 100 micro-coulombs, which corresponds to potential well depths of approximately 300 kV, have been measured as will be described in this report. Vertical magnetic field coils have been installed on the experiment, and preparations for high energy electron injection have been completed. Theoretical studies of high energy electron injection, including single-particle and fully-relativistic self-consistent calculations, are presented. In addition, a theoretical study of switching energy stored in the torus is reported. (Author)

Primary Keywords: Energy Storage; Electron Beams; Particle Accelerators; Toroids; Magnetic Fields; Simulation; High Voltage; Vacuum; High Energy

Secondary Keywords: Charge Injection; STP Experiment; NTISDOODA

8300
(POWER CONDITIONING)
(Pulse Forming Networks)
CONTROL OF THE SHAPE OF HIGH-CURRENT, HIGH-VOLTAGE PULSES GENERATED BY AN ARTIFICIAL LINE

L.I. Pivovar and E.G. Teller
Sandia Report No. SAND-77-6016 (09/1975).
Trans. From: KHFYI-73-20, pp 57-58 By P. Neuman
Availability: SAND-77-6016

NTIS

Several devices used in plasma physics, accelerator technology, etc., are supplied by current and voltage pulses of rectangular shape. When the load is variable or nonlinear, circuits containing active and passive loops incorporating a time delay are used to obtain the required pulse shape. These circuits are so expensive and time-consuming to design and develop, that it is desirable to develop a way to model them on a computer. Calculations necessarily include some simplifications, since some parameters can only be determined precisely by physical measurements on the finished device. The solution is described. (ERA citation 03:007763)

Primary Keywords: Accelerators; Power Supplies; Thermonuclear Reactors; Control Systems; Electronic Circuits; Pulse Shapers; Pulses; Shape

Secondary Keywords: ERDA/700203; ERDA/430300; Translations; USSR; Delay Circuits; Computerized Simulation; NTISDE

8302
(PULSE GENERATORS)

() DEVELOPMENT AND USE OF 60 KW, AND 150 KV FLOATING DECK MODULATORS FOR HIGH VOLTAGE PROTECTION OF MULTI-MEGAWATT ION BEAM ACCELERATORS

G.C. Barber, N.S. Ponte and G. Schilling

Oak Ridge National Lab., Oak Ridge, TN 37830

Availability: CONF-711029-67

NTIS

Extraction currents of 60 A at 40 kV have been produced by utilizing a 60 kV floating deck modulator interfaced to a high voltage power supply. The modulator is operated in a series mode to repetitively pulse power to the ion beam accelerator. Current monitoring and other protective circuits provide interrupt commands to the series switch tube when faults occur. The constant current characteristics of the water cooled tetrode and the rapid response of the protective circuits effectively limit the current and voltage of the ion source. Three of the 60 kV decks have been modified and stacked in a series configuration to supply 120 kV, 50 A pulses. This system supplies power for development of higher-energy multi-grid sources. In this system attention has been focused on forced voltage sharing of the three decks and on protective circuits for fault conditions. All control signal processing and conditioning is performed at ground level. Fiber optic links are used to interface with the high potential associated with the floating decks. A shunt modulator incorporated with this system provides regulation of the voltage to the ion source gradient grid. Future modulator development includes a system to deliver 100 A at 80 kV. (ERA citation 03:016254)

Primary Keywords: Ion Sources; Switching Circuits; Electric Currents; Electric Potential; Electronic Circuits; Modulation; Neutral Atom Beam Injection; Neutral Beam Sources; Ormak Devices; Pit Devices; Power Supplies; Specifications; Beam Injection; Tokamak Devices

Secondary Keywords: ERDA/700203; ERDA/700205; NTISDE

Distribution Restriction: U.S. SALES ONLY

8305
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)

GASEOUS DISCHARGE SWITCH IN OVERRSIZED WAVEGUIDE

J.P. Quinn and C. Younger

General Electric Co., Schenectady, NY 12301

Final rept. 1 Oct 64-30 Sep 55 (02/1966).

Availability: AD-A119 506/3ST

NTIS

The purpose of this investigation is to develop fast ultra high power switches compatible with the TE01 mode in oversized rectangular waveguides. The height and width dimensions are of the order of two free space wavelengths. Experimental switches are to be designed for operation at X-band. This report presents the results that were obtained in the technical and experimental investigation of DC triggered spark gap switches for oversized rectangular waveguide. These switches which operate at atmospheric pressure employ a symmetrical arrangement of several spherical spark gaps in order to prevent the generation of higher order propagating modes. The results of a theoretical and experimental study of low pressure gaseous electronic switches employing a Penning type of discharge are also included. (Author)

Primary Keywords: Waveguide Switches_X Band; Waveguides; Microwave Equipment; Gas Discharges; Electrodes; Standing Wave Ratios; Electronic Switches

Secondary Keywords: Spark Gaps; NTISDODX

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

8306
(FOHEP TRANSMISSION)
(Cables)

HIGH POWER, LOW NOISE PULSE CABLE

J. Arancio and R. Feller

ECOM, Fort Monmouth, NJ 07703

(01/1956).

Availability: AD-656 503

NTIS

Four new types of high power, low noise rubber pulse cables have been developed that have high power handling capacities, considerable flexibility over the ambient temperature range of -55°C to +55°C, exhibit good corona stability after long term cycling and effective shielding against the electromagnetic radiation emanating from these cables. A program has been established for the development of electrical terminations for these cables. The terminations for the RG-190/U, RG-191/U, RG-191'/U and RG-194'/U pulse cables will be of the hot-head type and the cable assemblies will be manufactured at the factory, which will insure corona free operation and ease of assembly to the equipments. Triaxial connectors for the RG-190'/U pulse cable are currently being developed. It is anticipated that the termination for the RG-190'/U, RG-191'/U and RG-192'/U pulse cables will be available by May 1957. A hydrogen thyratron test and aging equipment has been installed to experimentally verify the performance characteristics and curves based on calculated data under high pulse voltage and short pulse conditions. The equipment is capable of 5 megawatts peak power output.

Primary Keywords: Pulse Cables; Radio Frequency Power; Electric Insulation; Butyl Rubber; Silicone Plastics; Metal Connectors; Performance(Engineering); Voltage; Attenuation; Electromagnetic Shielding; Electric Connectors; Noise(Radar); Radar Equipment

8310
(PULSE GENERATORS, SWITCHES, CLOSING)
(Line Type; Gas Gaps; Electrical)

PRODUCTION OF MILLIMICROSECOND CURRENT PULSES USING A PRESSURIZED SPARK GAP

J.H. Adam and L.S. Holmes
Atomic Energy Research Establishment, Harwell, Berkshire, UK
Journal of Scientific Instruments, Vol. 37, No. 10, pp 385-388
(10/1968)

A pressurized spark gap has been designed to discharge a number of coaxial cables in parallel, thus producing a rectangular pulse of 10^4 A with a rise time of 4.5 nanoseconds. It is designed to use a number of these spark gaps in parallel, to test the feasibility of doing this, measurements have been made of the statistical variation of the time lag for breakdown after triggering. 3 Refs.

Primary Keywords: Coaxial Line; Pulse Transformer; Multiple Spark Gap Switching; Nanosecond Jitter; Parallel Gap Operation; Performance Test

COPYRIGHT 1968 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8311
(INSULATION, MATERIAL; BREAKDOWN STUDIES)
(Solid; Surface Flashover)

MEASUREMENTS OF THE CHARGE DISTRIBUTIONS ON AN ALUMINA INSULATOR IN VACUUM RESULTING FROM HIGH-VOLTAGE STRESS

J.P. Brard and D. Jensen
Sandia Labs, Albuquerque, NM 87115
No. CR-74-1207-1, 19p (10/1968)

Availability: SAND-74-1207-1

NTIS

For abstract, see NSA 30 09, number 26300.

Primary Keywords: Dielectric Materials; Electric Charges; Aluminium Oxides; Electric Potential; Electric Probes; High Vacuum; Measuring Methods; Stresses; Surfaces

Secondary Keywords: NTIS/SEC

8312
(INSULATION, MATERIAL)
(Solid)

METHODS FOR CREATION OF HIGH-VOLTAGE, HIGH-TEMPERATURE ELECTRIC INSULATION

V.I. Kalytynskii, A.M. Tuchinskii, M.N. Aleksandrov, E.Z. Annovich and V.A. Kolganova
Availability: GEFR-TR-802
NTIS

Methods for the production of high voltage (up to 6 kV) and high temperature (500 to 600 $^\circ$ C) electric insulation were studied. Insulation of this class can be produced using artificial mica and aluminophosphate. (ERA citation 03:01007)

Primary Keywords: Electrical Insulation; Aluminum Phosphates; Dielectric Materials; Dielectric Properties; Electrical Equipment; Fabrication; High Temperature; Mica; Performance Testing

Secondary Keywords: ERA/200500; Translations: USSR; NTISDET
Distribution Restriction: Translated from Elektrotekhnika 43 n5 p10-12
1972.

8314
PARTICLE-INITIATED BREAKDOWN IN GAS DIELECTRIC CABLE INSULATION EXPANDED SCOPE PROGRAM (FINAL REPORT)

C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
Availability: EPRI-EL-1264
NTIS

The adverse influence of conducting particle contaminants in gas-insulated power apparatus was investigated in a series of experiments that employed coaxial configurations and dc voltages to 1500 kV. Particle dynamics was shown to be important and related to breakdown initiation in the gas gap. Both SF₆ and N₂ sub 2 gases at pressures from 1 to 16 g/cm³ absolute were used. In some particles were intentionally introduced and ranged from 1.6 to 6.4 mm spheres and 1.6 g/cm³. Effects in the gas gap as well as along surfaces of solid insulators were studied. Visual observations, photographs, and electrical measurements helped in distinguishing various processes. Particles could reduce the insulation performance by factors of 3 to 5 and were especially significant when moved to the center conductor. By coordination of this work with a separate study at the Westinghouse R & D Laboratory a comparison between dc and ac performance was made. Generally, the dc breakdown values exhibited wider scatter, though their lower limit was similar to that found under ac. Overall fundamental forces and processes which involve particle contamination effects were identified and found to be the same for dc and ac voltage stresses. (ERA citation 03:01570)

Primary Keywords: Gas-insulated Cables; Dielectric Strength; Aluminum; Breakdown; Dielectric Cables; Comparative Evaluations; Dielectric Materials; Electrical Insulation; Experimental Data; Graphs; Nitrogen; Particles; Power Transmission Lines; Pressure Dependence

Secondary Keywords: ERDA/200302; NTISDE

8317
(SWITCHES, RECTIFIERS)
(Gate Turn-off Rectifier)

POWER AMPLIFICATION WITH GATE TURN-OFF CONTROLLED RECTIFIERS

R.G. Camacho
Naval Postgraduate School, Monterey, CA 93940

Master's thesis (10/1968);

Availability: AD-480 466/25T
NTIS

With ever larger amounts of power being required by present day active sonars, studies are being made towards improving the efficiency of the power train. A gain in efficiency is possible if non-linear switching type amplifiers are used instead of the linear amplifiers presently used. Due to its high switching efficiency, fast switching, and ability to be turned on and off by gate signals, the Gate Turn-off Controlled Rectifier was investigated for possible application in an amplifying circuit. The circuit examined readily met the required criteria; however, the real value of this study lies in the method of predicting transient performance. Use of the derived equivalent circuit, and an analog computer model based on transfer functions (E sub 1/E and I sub 1/I/E), provide analytical solutions that can be arrived at more readily than by other methods. (Author)

Primary Keywords: Transistors; Amplifiers; Sonar Equipment; Rectifiers; Sonar Equipment; Power Amplifiers; Sonar Equipment; Gate Circuits; Gain; Voltage; Electric Currents; Transducers; Solid State Theory; Trigger Circuits; Diodes; Active

Secondary Keywords: Semiconductor Junctions; NTISDODXO

Distribution Restriction: Distribution limitation now removed

8318
(PULSE GENERATORS)

(Mark)

PULSE CIRCUIT FOR N/SUB 2/ LASERS
D. Steinwall, A. Widén, A. Anvari and R. Nilsson
Research Inst. of National Defence, Stockholm (Sweden)
No. FOA-2-C-2503-E1, 32p (11/1971).
Availability: NTIS-N74-13210/1
NTIS

A very simple pulsed gas laser has been constructed for generating short laser pulses with high power, high repetition frequency and good stability. The system has been tested for nitrogen at 3371 Å. The following data have been obtained: Pulse length 5 ns, output power 503 kW, and repetition frequency 100 cps. The cavity can be used for laser wave lengths with less reinforcement. Some of the physical parameters have been made adjustable such as coherence characteristics of amplitude, beam divergence, etc. The circuit has been built on the well-known Marx generator principle and can also be used as a pulses are required, for example, for producing short X-ray flashes. A disadvantage of the circuit is that it has rather many spark gaps which produce certain problems concerning flash overs. (Author)

Primary Keywords: Circuits; Gas Lasers; Pulse Generators; Pulsed Lasers; Flashover; Laser Outputs; Nitrogen; Spark Gaps

Secondary Keywords: IN SWEDISH; NASA

8319
(ENERGY CONVERSION, ELECTRICAL)

(Power Supplies)

SEMICONDUCTOR MEASUREMENT TECHNOLOGY: A VERSATILE HIGH-VOLTAGE BIAS SUPPLY FOR EXTENDED RANGE MIS C(V) AND G(V) MEASUREMENTS

P.H.H.O. Kozlowski and A.M. Goodman
RCA Labs, Princeton, NJ 08540
Special rept. (12/1977)

Availability: PB-274 939/8ST

NTIS

Recently developed technology has enabled the measurement of MIS C(V) and G(V) at bias-voltage magnitudes as large as 25 kV. This report describes a versatile high-voltage power supply intended for use as a bias source in carrying out such measurements. The design allows the user a wide variety of options in the selection of the sweep function (waveform), sweep time, initial bias voltage, and the amplitude of the bias sweep. There are six possible ramp functions: (1) increasing ramp, (2) decreasing ramp, (3) positive polarity half-wave sawtooth (increasing ramp followed by decreasing ramp), (4) negative polarity half-wave sawtooth (decreasing ramp followed by increasing ramp), (5) full-wave sawtooth starting with increasing ramp, and (6) full-wave sawtooth starting with decreasing ramp. Either single or repetitive sweeps may be selected. The sweep time from the initial value to the end of the first ramp segment may be varied from 1 to 2000 s. Operator convenience is enhanced by certain features of the design; among these are light-emitting diodes which display the state of the sweep and automatic pen control if the sweep is used with an x-y recorder.

Primary Keywords: Semiconductors; Measurement; Power Supplies; High Voltage; Bias; Capacitance; Electrical Resistance; Function Generators; Semiconductor Devices; Sweep Circuits; Electric Measuring Instruments

Secondary Keywords: Metal Insulator Semiconductors; Silicon On Sapphire; NTISCOMNS; NTISDDOSD

8321
(BREAKDOWN STUDIES)

(Exploding Wires)

STRIATIONS IN EWPs

H. Goronkin
Temple University, Philadelphia, PA 19122
Doctoral Thesis No. 2, Scientific-2, 19p (10/1968).

Availability: AD-685 17

NTIS

Striations in exploding wires have been examined in sequential frame studies to investigate the possibility that gas discharge type striations are formed in the electron-van der Waals sheath. These electrical striations, due to localized space charge fields, may move in the direction of major tv electric current carrier motion. Explosions were carried out in samples immersed in distilled water in order to reduce currents which could mask striations. No. 28 copper wire samples 1.1 and 2 cm lengths were connected across a 45 microfarad capacitor bank charged to 3 to 8 kV. Within the range of electric fields used in this experiment, no movement of striations were observed. Comparison of striations in annealed and unannealed wires show that it is not likely that low velocity striations are present. The existence of mechanical striations has been firmly established. (Author)

Primary Keywords: Exploding Wires; Electric Fields; Gas Ionization; Ionization Potentials; Vaporization; Charged Particles; Theses

Secondary Keywords: EWP (Exploding Wire Phenomena); Exploding Wire Phenomena; Mechanical Striations; Electrical Striations; Striations

8322
(PARTICLE BEAMS, NEUTRAL)

(Generation)

STUDY OF EFFICIENT HIGH-POWER, HIGH-ENERGY NEUTRAL BEAMS FOR THE REFERENCE MIRROR REACTOR

J.H. Fink, W.L. Barr and G.W. Hamilton

Lawrence Livermore Lab., Livermore, CA 94550

(11/1976)

Availability: UCRL-52173
NTIS

An injector design for the Reference Mirror Reactor is described which uses negative ions created by charge-exchange in a cesium vapor cell and neutralized by photodetachment. Some of the innovations discussed include a continuously operating cathode for an LBL/LLL ion source, a negative ion beam line with cooled grids, a high voltage accelerator configuration with insulators shielded from the neutron and gamma flux, and cryopanels which continuously cycle between pumping and outgassing modes. (ERA citation 02:031659)

Primary Keywords: Magnetic Mirror Type Reactors; Neutral Atom Beam Injection; Cathodes; Design; Efficiency; Electrodes; Ion Sources; Performance

Secondary Keywords: ERDA/700205; NTISERDA

8324
(BREAKDOWN STUDIES)
(Gas; Electrical)

THE EFFECT OF HUMIDITY ON A CORONA DISCHARGE IN AIR

B.R. Maskell
Royal Aircraft Establishment, Farnborough, UK
No. RAE-TR-70106, 27p (06/1970).
Availability: N71-24373
NTIS

Primary Keywords: Electric Corona; Humidity Measurement; Moisture Meters; Atmospheric Moisture; High Voltages; Pressure Effects; Response Time (computers); Temperature Effects; Volt-ampere Characteristics

8325
(BREAKDOWN STUDIES)
(Gas; Optical)

THE GUIDANCE OF HIGH-VOLTAGE ELECTRICAL BREAKDOWN STREAMERS BY LASER INDUCED IONIZATION IN AIR

Markska
Verses Inc., Springfield, VA 22151
Final scientific rept. (06/1973).
Availability: AD-763 827
NTIS

Experimental studies and theoretical analysis have shown that the breakdown paths and propagation velocity of high voltage electrical streamers can be modified and controlled by laser radiation at intensities less than the optical breakdown threshold. In air at atmospheric pressure, 450 KV negative streamers have been guided along selected paths about 7 cm in length, and their propagation velocities of the streamers have been increased from 1×10^6 to the power of 7 cm/sec to 3×10^6 to the power of 8 cm/sec, by 1.66 micrometer radiation pulses of 200 Joules energy and 60 nsec half-width. Direct measurements of the degree of ionization along the laser beam path showed about 10 to the power of 10 - 10 to the power of 11 ion pairs/cc are produced at the beam intensities used in the studies. (Modified author abstract)

Primary Keywords: Gas Ionization; Coherent Radiation; Electric Discharges; Lasers; Optical Equipment; Electrodes; Recombination Reactions; Ions; Electron Density

Secondary Keywords: Laser Beams; Dielectric Breakdown; Q Switched Lasers; Nuclear Fusion; AF

8326
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

THEORETICAL AND EXPERIMENTAL STUDY OF THE CURRENT DISTRIBUTION IN COILS COUPLED TO IMPULSE DYNAMOS

B. Geoffrion and M. Legentil
Paris University, Orsay, France
No. LF-10, 29p (03/1973).
Availability: N74-17456/6
NTIS

The features of coils to be coupled to homopolar impulse generators were determined in order to maximize transfer efficiency from kinetic to magnetic energy. The current distribution inside the coils was computed, together with the resulting magnetic induction, and a comparison was made with experimental results obtained using a 5 MJ generator. (Author)

Primary Keywords: Electric Energy Storage; Energy Conversion Efficiency; Impulse Generators; Magnetic Coils; Current Distribution; Electrical Engineering; High Voltages; Impedance; Magnetic Induction; Time Dependence

Secondary Keywords: NASA

8329
(POWER CONDITIONING)
(Pulse Forming Networks)

A PULSE-FORMING NETWORK FOR PARTICLE PATH VISUALIZATION

K.W. McElroy
Aeros Research Center, Moffett Field, CA
Technical memo. No. NASA-A-8671, 18p (11/1981).
Availability: AD-A108 424/3
NTIS

A procedure is described for visualizing nonsteady fluid flow patterns over a wide velocity range using discrete nonluminous particles. The paramount element responsible for this capability is a pulse-forming network with variable inductance that is used to modulate the discharge of a fixed amount of electrical energy through a xenon flashtube. The selectable duration of the resultant light emission functions as a variable shutter so that particle path images of constant length can be recorded. The particles employed as flow markers are hydrogen bubbles that are generated by electrolysis in a water tunnel. Data are presented which document the characteristics of the electrical circuit and establish the relation of particle velocity to both section induced and film exposure. (Author)

Primary Keywords: Pulse Generators; Electrical Networks; Water Tunnels; Flash Lamps; Xenon Lamps; Flow Fields; Particles; Paths; Shutters(Optics); Images; Bubbles; Patterns; Hydrogen; Electrolysis; Exposure(General); Functions; Films; Electricity; Circuits; Light

Secondary Keywords: Pulse Forming Networks; Flow Visualization; Unsteady Flow; Streamline Visualization; NTISDODXA; NTISNASA; NTISDODA

8337
(SWITCHES, CLOSING)

(1) DEVELOPMENT OF HIGH VOLTAGE-HIGH CURRENT SWITCHES (FINAL REPORT)

H.N. Price
General Electric Co., Schenectady, NY 12301
No. NASA-CP-61519, 48p (02/1966).
Availability: N68-17073
NTIS

Primary Keywords: Electrical Properties; High Voltages; Switches; Trigger Circuits; Tube Anodes; Vacuum Tubes; Electric Potential; Envelopes; Hydrogen Plasma; Ignitrons; Tube Cathodes

8347
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

FDX: A FAST DISCHARGE HOMOPOLAR GENERATOR
H.M. Woodson (1), D.J. Mayhall (1) and H.G. Rylander (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
No. CONF-771132-4, 12p (01/1977).
Availability: ORD-5594-8
NTIS

A study was undertaken to determine the fundamental limitations to the discharging time of homopolar generators. As a result of the study, a Fast Discharge Experiment (FDX) was proposed. FDX is a small (365 kJ), counterrotating disk type homopolar generator designed to explore the limits to homopolar generator discharge times. The FDX rotors are forged aluminum alloy with flame sprayed copper slip rings. Solid copper graphite brushes are used with 95% packing factor on the slip rings. The high magnetic field required for fast discharge (3.1 T average) is provided by discharging the CER 5.0 MJ homopolar generator into a four-turn, graphite-reinforced, room temperature copper coil. Since the field is pulsed and FDX rotors cannot be self motored, they are brought up to speed with two 37 kW air turbines. The two aluminum rotors are 30 cm in diameter and of a rimmed, modified constant stress configuration. They are designed for a maximum operating speed of 28,000 r/min at which point they each store 182.5 kJ and develop 104 V. The aluminum discharge coax is approximately 35 cm in diameter and is designed to carry the 1.88 MA starting current from the 1000 r/min short circuit discharge which would stop the rotors in 1.0 ms. It is predicted that the machine will ring on its own internal impedance for approximately five cycles in this mode. The discharge coax is shorted by four very fast making switches.

Primary Keywords: Electric Generators; Thermonuclear Reactors; Aluminum; Configuration; Gas Turbines; Operation; Pators; Specifications

Secondary Keywords: ERDA/700203; DC Generators; Fast Discharge Experiment; NTISDE

8355
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

HMOPOLAR GENERATOR DEVELOPMENT AT THE UNIVERSITY OF TEXAS
W.F. Weldon (1), H.M. Woodson (1) and Rylander H.G. (2)
(1) University Of Texas At Austin, Austin, TX 78712
(2) Department Of Energy
No. CONF-771132-3, 9p (01/1977).

Availability: ORD-5594-7
NTIS

Homopolar generator development since 1972 is reviewed. The first homopolar generator stored 0.65 MJ was capable of self motoring to 6000 r/min in about 12 min with an armature current of 1.0 KA and could discharge in about 3.5 s at a current of 14.0 KA. A high brush tester to evaluate mechanical and electrical properties of the various grades of solid brushes available is mentioned. The second homopolar generator stores 5.0 MJ of energy inertially at 5600 r/min and is basically an accelerated version of the first generator with improved bearings and brush mechanism. Work on basic design and industrial programs is mentioned. (ERA citation 03:025509)

Primary Keywords: Electric Generators; Thermonuclear Reactors; Design; Fabrication; Operation; Performance Testing; Power Supplies; Specifications

Secondary Keywords: ERDA/700203; DC Generators; NTISDE

8361
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

MODEL AIR-SUPPORTED DRUM-TYPE HOMOPOLAR GENERATOR
R.L. Kustom, R.E. Fuje, R.B. Wehrle, R.P. Smith and T.J. Kovarik
Argonne National Lab, Argonne, IL
(01/1977).

Availability: CONF-771132-6
NTIS

A single cylinder, drum-type homopolar generator has been designed and built for the purpose of developing a simple air support system for thin cylinder rotors operated at high surface velocities and significant radial drum growth. The model has an aluminum cylinder which is 0.32 cm thick, 25 cm in diameter, and 12.7 cm long. It is designed to operate at a peak current of 2500 A and to store a total of 40 kJ with a surface velocity of 305 m/sec. (ERA citation 03:049215)

Primary Keywords: Electric Generators; Air; Cylindrical Configurations; Design; Electric Contacts; Levitation; Power Supplies; Rotation; Thermonuclear Reactors

Secondary Keywords: ERDA/700203; DC Generators; NTISDE

8373
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)
OPTICAL METHODS OF ELECTRICAL MEASUREMENT AT HIGH VOLTAGE LEVELS
R.E. Hebner, R. Malewski and E.C. Cassidy
National Bureau of Standards, Washington, DC
Final rept. (11/1977).

Availability: PB-282 879/6ST

Optical methods to measure electric parameters and transmit the information from high voltage circuits to ground potential are described and evaluated in the light of the specific requirements of high voltage measurement applications. The history and physics of a variety of opto-electrical methods found suitable for electrical measurement applications are introduced. Existing optical devices for high voltage measurement and their applications in power systems in high voltage circuits are reviewed with emphasis on the operation and features of several selected methods. The use of these techniques in high voltage and industrial power systems, in research laboratory apparatus, and in reference standards laboratories is discussed.

Primary Keywords: Electrical Measurements; Optical Measuring Instruments; High Voltage; Faraday Effect; Kerr Magnetooptical Effect; Electrooptics; Birefringence

Secondary Keywords: NTISCOMNBS
Distribution Restriction: PUB. IN PROCEEDINGS OF IEEE, V65 N11
PI524-1548 NOV 77.

8367
(REVIEWS AND CONFERENCES; PARTICLE BEAMS)

(Conferences; Reviews)

PROCEEDINGS OF THE INTERNATIONAL TOPICAL CONFERENCE ON HIGH POWER ELECTRON AND ION BEAM RESEARCH AND TECHNOLOGY (2ND), OCTOBER 3-5, 1977; VOLUME I

J.A. Nation and R.N. Sudan
Cornell University, Ithaca, NY 14850
Final rept. (03/1978).

Availability: AD-A057 218/85T

HTIS

Contents: Generation and Transport of Intense Beams; Energy Deposition in Targets; Beam Plasma Interactions; and Charged Particle Rings.

Primary Keywords: Electron Beams; Ion Beams; Particle Accelerators; High Energy; Nuclear Fusion; Confinement (Nuclear Reactors); Explosions; Ion Bombardment; Plasmas (Physical); Meetings; Symposia

Secondary Keywords: Storage Rings; Meetings; NTISDODXA

8368
(REVIEWS AND CONFERENCES; PARTICLE BEAMS)

(Conferences; Reviews)

PROCEEDINGS OF THE INTERNATIONAL TOPICAL CONFERENCE ON HIGH POWER ELECTRON AND ION BEAM RESEARCH AND TECHNOLOGY (2ND), OCTOBER 3-5, 1977; VOLUME II

J.A. Nation and R.N. Sudan
Cornell University, Ithaca, NY 14850
Final rept. (03/1978).

Availability: AD-A057 219/85T

HTIS

Contents: Collective Accelerators; Microwaves and Unneutralized E-Beams; Technology; and Laser Applications.

Primary Keywords: Electron Beams; Ion Beams; Electron Accelerators; Ion Accelerators; Relativity Theory; Lasers; Transport Properties; Laser Pumping; Symposia

Secondary Keywords: Reflex Triodes; Meetings; NTISDODXA

8383
(INSULATION, MATERIAL)

(Liquid)

WATER AS DIELECTRIC IN HIGH-VOLTAGE IMPULSE DEVICES

V.Y. Ushakov

(10/1976).

Availability: UCRL-Trans-11185

HTIS

In exploding-wire and ultrafast plasma-heating experiments, for the production of high-power x-ray flashes and fast-electron pulses, and in a number of other situations, generators of large impulse currents (10 exp 6 A) and voltages (10 exp 6 to 10 exp 7 V) with nanosecond fronts are needed. The results available in the literature and the author's data on the principal aspects of the use of water as a dielectric in high-voltage impulse storage and switching devices are summarized. (ERA citation 02023161)

Primary Keywords: High-voltage Pulse Generators; Water; Dielectric Properties; Electrical Insulation; Energy Storage; Switches.

Secondary Keywords: ERDA/420800; ERDA/360603; Translations: USSR; Dielectrics; NTISERDA

Distribution Restriction: TRANSLATED FROM PP 96-111 OF POWERFUL NANOSECOND IMPULSE SOURCES OF ACCELERATED ELECTRONS, IZDATEL'STVO "NAUKA", NOVOSIBIRSK, 1974.

8390
A SIMPLE GENERATOR OF SEVERAL-HUNDRED-KILOVOLT PULSES WITH NANOSECOND RISE TIMES

J.C. Blackburn and R.D. Genuario
Harry Diamond Labs, Washington, DC 20438
No. HDL-TM-73-24, 21p (11/1973).

Availability: AD-780 027/9

HTIS

A system for producing rectangular 0.5 MV pulses with rise times of about 1 nsec and duration between 5 and 20 nsec is described. A coaxial line is pulse-charged from a Martin-type autotransformer and then discharged by a fast-twitch high-current switch to a matched CuSO₄ load resistor. A low-inductance capacitive voltage divider allows monitoring of the pulse. The jitter and delay in the discharge switch total less than a microsecond, allowing synchronization with other events. The system has been in use for 1-1/2 years with satisfactory results. (Author)

Primary Keywords: Pulse Generators; Short Pulses; Nondestructive Testing; Ceramic Materials

Secondary Keywords: NTISA

8399
ANTARES PROTOTYPE 300-KJ, 250-KA MARX GENERATOR (FINAL REPORT)

K.B. Pierce, L.L. Parrone, K.J. Dickford and G.H. Livermore

Los Alamos National Lab., Los Alamos, NM 87545

(01/1981).

Availability: LA-8491

HTIS

A high-energy, low-inductance, low prefire rate, low trigger jitter, high-voltage, pulsed-power supply was needed to drive the gas discharge in the Antares laser power amplifier. This report describes the design and testing of a Marx generator that meets these requirements, the development and testing of a high-capacity spark gap, and the selection of suitable capacitors and resistors. (EPA citation 03 010021)

Primary Keywords: Antares Facility; Carbon Dioxide Lasers; Power Supplies; Capacitors; Design; Performance Testing; Resistors; Spark Gaps

Secondary Keywords: ERDA/700228; ERDA/420300; NTISDE

8403
(ENERGY STORAGE, CAPACITIVE; PULSE GENERATORS)

(Marx Generators; Marx)

COAXIAL MARX GENERATOR FOR PRODUCING INTENSE RELATIVISTIC ELECTRON BEAMS

Y. Kubota, S. Kawachi, A. Miyahara and H. Sead

Nagoya University, Nagoya, Japan

Japanese Journal of Applied Phys. Vol. 13, No. 2, pp 260-263
(02/1974).

The construction and operation of a coaxial Marx generator is described in this paper. An output voltage of 600 kV, 80 nH inductance, and stored energy of 160 J make this Marx generator a good candidate for e-beam generation. With a diameter of 75 cm and length of 140 cm, the device is also very compact. (6 Refs)

Primary Keywords: Marx Generator; Coaxial Configuration; 80 nH Inductance; 600 kV Output Voltage; 160 J Stored Energy

COPYRIGHT © 1974 BY THE PUBLICATION BOARD, JAPANESE JOURNAL OF APPLIED PHYSICS

8407
(REVIEWS AND CONFERENCES; ENERGY STORAGE, CAPACITIVE)

(Reviews; Reviews)

Critical Pulse Power Components

(1) Los Alamos National Lab., Los Alamos, NM 87545

(2) Sandia Labs, Albuquerque, NM 87115

Los Alamos Report No. CONF-810812-9 (08/1981).

Availability: LA-UR-81-1249

HTIS

Critical components for pulsed power conditioning systems will be reviewed. Particular emphasis will be placed on those components requiring significant development efforts. Capacitors, for example, are one of the weakest elements in high-power pulsed systems, especially when operation at high-repetition frequencies for extended periods of time are necessary. Switches are by far the weakest active components of pulse power systems. In particular, opening switches are essentially nonexistent for most applications. Insulation in all systems and components requires development and improvement. Efforts under way in technology and device development of pulse power components will be discussed. (37 Refs)

Primary Keywords: Pulsed Power Conditioning Systems; Long Life Energy-transfer System Components; High Energy Density Capacitors; Capacitor Development

8414

DEVICE FOR GENERATING POWERFUL ELECTRICAL PULSES

B.I. Kulikov, V.M. Lagunov, Y.V. Nesterikhin and V.M. Fedorov

FID, Wright-Patterson AFB, OH

No. FID-IDCR517-2129-78, 8p (12/1978).

Availability: AD-A066 677/65T

HTIS

No abstract available.

Primary Keywords: Pulse Generators; Translations: USSR

Secondary Keywords: Patents; NTISDODXA; NTISFMUR

8594

ACTIVE LAMP PULSE DRIVER CIRCUIT

K.E. Logan

Goddard Space Flight Center, Greenbelt, MD

Patent Application No. PAT-APPL-6-276 748, 24p (12/1978).

Availability: HSR-10390/4

HTIS

A flashlamp drive circuit is described in detail. The device uses an unsaturated transistor as a current mode switch to periodically subject a partially ionized gaseous laser excitation flash-lamp to a stable, rectangular pulse of current from an incomplete discharge of an energy storage capacitor. A monostable multivibrator sets the pulse interval, initiating the pulse in response to a flash command by providing a reference voltage to a non-inverting terminal of a base drive amplifiers. A tap on an emitter resistor provides a feedback signal sensitive to the current amplitude to an inventory terminal of a feedback amplifier, thereby controlling the pulse amplitude. The circuit drives the flashlamp to provide a square-wave current flashlamp discharge.

Primary Keywords: Patent Applications; Flash Lamps; Optical Pumping; Pulse Generators; Pulsed Lasers; Switching Circuits; Current Regulators; Feedback Circuits; Ionization; Laser Pumping; Optical Resonators; Pulse Amplifiers; Square Waves; Transistor Circuits

Secondary Keywords: NTISGPNASA

Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE HTIS.

8595

AN ELECTROMECHANICAL PULSE SOURCE

G.A. Sipelev, A.V. Loos, Y.M. Romanov and V.F. Sergeyev

FID, Wright-Patterson AFB, OH

No. FID-IDCR517-0662-81, 8p (08/1981).

Availability: AD-A103 779/5

HTIS

No abstract available.

Primary Keywords: Pulse Generators; Alternators; Short Circuits; Electric Coils; Stators; Rotors; Translations: USSR

Secondary Keywords: Electromechanical Sources; Synchronous Generators; NTISDODXA; NTISFNUR

8601

AN X-RAY DIAGNOSTIC FOR LIGHT-ION CURRENT MEASUREMENTS

R.D. Bleach, D.J. Hegel, D. Mosher and S.J. Stephanakis

National Research Lab, Washington, DC 20375

Memorandum rept. No. NRL-MR-4462, 29p (03/1981).

Availability: AD-A095 923/9

HTIS

A technique to determine the number and current density of MeV protons in an intense beam was tested on the GAMBLE II generator. Diode current and voltage and an absolute measurement of K-line radiation emitted from a 6 micrometer thick aluminum target were used to determine the number and current density of protons incident on the target. Time-dependent x-ray measurements can be used to infer variations in the ion-beam current density.

Primary Keywords: Proton Beams; X-Ray Diagnostics; Current Density; Spectrum Analysis; Pulse Generators; Metal Films; Targets; Aluminum; Emission Spectra

Secondary Keywords: GAMBLE 2 Pulse Generators; NTISDODXA

2/10

8602

ARC DISCHARGE SOURCES

C.H. Church and R.G. Schlicht
Westinghouse Research and Development Center, Pittsburgh PA
Semiannual technical summary rep. no. 1, 16 Oct 64-15 Apr 65 No.
60-911-148-R3, 129p (05/1965).
Availability: AD-452 792/33T
NTIS

A simple theoretical model for the high energy pulsed arc discharge has been proposed, in which thermal conduction and radiative transfer occur within the arc. Radiative transfer is discussed both in general and as applied to the model. The theoretical evaluation of the various physical properties of the arc plasma, that are required in finding a solution to the model, including absorptivity, thermal and electrical conductivities are described using simple and relatively complete expressions. Calculations which consider the arc to be of homogeneous temperature of the form of a plane parallel slab and cylinder are described, with results indicated for the plane parallel slab using simplified representation of the electron density and absorptivity. Experimental measurements necessary to validate the model are discussed. Measurements of the spectral radiance in the ultraviolet at different radial points are presented. (Author)

Primary Keywords: Electric Arcs; Lasers; Mathematical Models; Electric Discharges; Electron Density; Programming (Computers); Ultraviolet Radiation Measurement; Thermal Conductivity; Electrical Conductivity; Argon; Krypton; Xenon; Transport Properties; Emissivity

Secondary Keywords: Defense Project; Electric Discharge Lasers; Laser Pumping; NTISODDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

8603

BLUMLEIN LINE GENERATION OF LONG-PULSE, PRECISELY REGULATED WAVE SHAPES FOR NONLINEAR RESISTIVE LOADS

W.A. Reass
Los Alamos National Labs, Los Alamos, NM 87545
No. LA-UR-81-1670, 4p (01/1981).

Availability: DEB102538D
NTIS

This paper describes the criteria utilized in the design of a long-pulse, offset-tuned Blumlein line. It is capable of 100- μ s, medium repetition rate (1/kC), 200-kV pulses for nonlinear loads (such as klystrons), with a total power deviation of less than 0.5% (tripple, overshoot, and droop, inclusive). (ERA citation 06:027550)

Primary Keywords: High-voltage Pulse Generators; Experimental Data; Klystrons; Pulse Shapers; Pulses; Tuning

Secondary Keywords: ERDA/420800; NTISDE

8604

CALCULATIONS FOR EXPLOSIVE MAGNETIC GENERATORS

S.G. Hibben
Informatics, Inc., Rockville, MD
Interim rept.: (10/1976).
Availability: AD-A107 746/0
NTIS

This is a translation of a Soviet paper which develops generalized criteria for optimum design of an explosive magnetic generator. Studies on techniques for pulsed compression of magnetic fields, with the resultant high pulse power generation, were actively pursued in the late 1960s and the early 1970s both here and abroad. In recent years the interest in these techniques appears to have dwindled, notably in the U.S. A recent search by the Smithsonian Science Information Exchange, in fact indicates no current U.S. research program under way on explosive compression of magnetic fields. In contrast, a continuing study of explosive cumulation is being maintained in the USSR. In particular under the direction of B. S. Luk'yev and Lobanov at Novosibirsk. These authors have published a series of papers on theoretical and experimental aspects of explosive compression, in which both coaxial and planar sandwich geometries have been investigated. (Author)

Primary Keywords: Explosive Decompression; Pulse Compression; Pulse Generators; Magnetic Fields; Explosive Charges

Secondary Keywords: Explosive Magnetic Generators; Magnetic Flux; Magnetic Field Compression; NTISODDXA

8607

COLLECTIVE ION ACCELERATION AND ELECTRON BEAM PROPAGATION IN DIELECTRIC GUIDES

W.D. Heilerson
Spire Corp., Bedford, MA 01730
Final rept. 1 Feb 79-31 Jan 81; No. FR-10067, 59p (05/1981).
Availability: AD-A102 874/5
NTIS

The propagation of electron beam currents much greater than the space charge limit and collective ion acceleration in evacuated dielectric guides was investigated. Experiments at Spire and at the Gamble I facility of NERL show that the beam front propagation velocity is not affected by the dielectric guide downstream from the anode region of the accelerator. The propagated current, however, depends strongly on guide parameters, and is considerably diminished in a shortened guide configuration. Collectively accelerated ions were not observed using the 40 ns, 200 keV electron accelerator at Spire, although earlier experiments using longer, lower energy pulses showed considerable ion acceleration. Proton energies more than 14 times the electron beam energy were observed during the experiment on Gamble I. An estimated 2×10^6 to the 9th power) protons at 12 MeV or greater along with 3×10^6 to the 11th power) protons at 5 MeV or greater were observed in a single shot. The origin of the collective acceleration is attributed to increasing the anode foil of the accelerator. Suggestions for increasing the energy and yield of collectively accelerated ions include improving the homogeneity of the downstream plasma and reducing the magnetic field of the propagating electron beam current. (Author)

Primary Keywords: Ion Accelerators; Dielectric Waveguides; Limiters; Space Charge; Current Density; Vacuum; Electron Beams; Ion Beams; Plasma Diagnostics; Neutron Activation

Secondary Keywords: Gentle I Pulse Generator; NTISODXA; NTISODDAF

8608

COLLECTIVE ION ACCELERATION WITH INTENSE RELATIVISTIC ELECTRON BEAMS

R.B. Miller and D. Straub
AFRL, Kirtland AFB, NM 87117
Final rept. No. AFRL-TP-75-236, 80p (04/1976).
Availability: AD-4025 943/25T
NTIS

Recent theoretical and experimental investigations of ion acceleration occurring when an intense relativistic electron beam is injected into low pressure neutral gases have yielded a fairly complete description of the process. In this report the experimental procedure and results of the collective ion acceleration program at the Air Force Weapons Laboratory, including related diode and beam propagation work, are examined in detail. Important conclusions pertaining to the existence of an ion acceleration threshold current, to accelerated ion energy spectra, and to process efficiency are reported. (Author)

Primary Keywords: Ion Accelerators; Electron Beams; Pulse Generators; Optics; Threshold Effects; Energy; Spectra; Streak Camera; Space Charge; Electric Current; Ionization; Neutralization

Secondary Keywords: Relativistic Beams; Collective Acceleration; Beam Propagation; Neutral Gases; Drift Tubes;

- NTISODDXA; NTISODDF

8617

DIELCTRIC MATERIALS FOR STRUCTURAL APPLICATIONS AND HIGH-VOLTAGE INSULATION IN REIONIZED WATER FOR PARTICLE-BEAM ACCELERATORS

J.P. Furaus
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-1713C, 4p (01/1981).

Availability: DEI027203

NTIS

The pulsed energy programs at Sandia National Laboratories (SNLA) have often required dielectric materials that provide a dual role of high voltage insulation as well as critical structural support. One typical application is the dielectric tension rods for the triatron-gas switch used on the PBFA-I Accelerator. This paper describes the performance of dielectric materials used in the past and recent evaluations of alternative materials that have resulted in significant cost and performance improvements. (ERA citation 06:029174)

Primary Keywords: High-voltage Pulse Generators; Linear Accelerators; Electrical Insulators; Mechanical Structures; Performance; Pulse Techniques; Switches

Secondary Keywords: ERDA/430303; NTISDE

8618

DIRECT CONTROL OF LARGE POWER SERIES TRIMOS WITH TRANSISTORS FOR HIGH VOLTAGE POWER SOURCE

M. Fukuda and K. Matsuda
Nagoya University, Nagoya, Japan
(02/1979).

Availability: IPPJ-DT-62

NTIS

The control of high voltage, large power output is often required in high frequency power sources for plasma experiments. For this purpose, power transmitter tubes such as triodes or tetrodes have been used as the series control tubes. However, in case of large power, the driving power for the series control tubes also becomes large and it leads to the requirement of large size and high cost. In order to solve such problem, the driving with transistor circuits has been experimented. Transistor circuits permit large current, but have comparatively low withstand voltage. However, the problem of withstand voltage has been solved by employing multi-stage series connection. First, the transistor circuit used has been analyzed, and the testing circuit was produced for trial and tested. The selected transistors were 2SD520 of Darlington connection as the main transistors, and 2SC995 or FET 2SK98C as the prestige transistor. The power source of +254 V to -140 V has been prepared. In general, such a circuit tends to cause parasitic oscillation (of several MHz). To prevent this oscillation, capacitors of approximately 10.0 pF were connected in parallel with bleeder resistors. These capacities did not affect the response speed of the system. Since the transistor failures in such a system may cause load breakage, the circuit must be protected by employing current limiters such as fast blowing fuses and Zener diodes for the protection from surge voltage. In the practically applied

Primary Keywords: High-voltage Devices; DC Amplifiers; Electronic Circuits; High-voltage Pulse Generators; Klystrons; Plasma; Power Conditioning Circuits; Power Supplies; RF Systems; Transistors

Secondary Keywords: IN JAPAN; SE; NTISDE; NTISFNJA

Distribution Restriction: U.S. SALES ONLY.

8620

ELECTRIC MACHINE SOURCE OF IMPULSES

S.A. Sipavlov and A.V. Loos
FTD, Wright-Patterson AFB, OH
No. FTD-IDCP-T-0663-81-6P (07/1981).

Availability: AD-A103 466/9

NTIS

No abstract available.

Primary Keywords: Pulse Generators; Synchronization(Electronics); Magnetic Drives; Patents; Translations

Secondary Keywords: NTISODDXA; NTISFNUR

8627

EXPERIMENTS IN MAGNETIC SWITCHING

C.L. Birx, E.J. Lauer, L.L. Regnato, D.J. Rogers and M.W. Smith
Lawrence Livermore Lab, Livermore, CA 94550
No. CONF-810659-4, 9p (05/1981).

Availability: UCRL-85758

NTIS

Magnetic switching offers an alternative to overcoming the repetitive end-to-end limitations of the spark gaps in the EIA/ATA induction accelerators. This principle has been applied for many years to radio modulators but at much lower power levels and longer pulse lengths. Concentrately recent developments in magnetic materials together with some optimal circuits have made it possible to go well beyond the state of the art. A magnetic modulator has been built which stores up and compresses a 25 kV, 5 μ s pulse into a 250 kV, 50 μ s pulse. A second magnetic modulator has been built and installed to replace four blumjones and spark gaps in order to provide triggers for the complete EIA injector and accelerator. The paper outlines some practical and theoretical considerations affecting the design of the magnetic pulse generator. (ERA citation 06:024087)

Primary Keywords: Linear Accelerators; Switching Circuits; Kev Range 100-1000; Kilo Amp Beam Currents; Magnetic Fields; Repetitive; Performance; Pulse Generators; Trigger Circuits

Secondary Keywords: ERDA/430303; NTISDE

8628
EXPERIMENTS ON THE INTERACTION OF HIGHPOWER MICROWAVES WITH AIR
W.M. Bollen, R.K. Parker and W.M. Black
Mission Research Corp., Alexandria, VA
Final report, 4 Apr 80-4 Jun 81 No. MRC/MDC-R-015, 37p (07/1981).
Availability: AD-A104 390/8
NTIS

The physics of gas breakdown for large collision frequency, nuvomegatron, has been pursued at the Nova Research Laboratory. The hybrid inverted coaxial magnetron, 500MHz, 3.2 GHz, 30ns pulse width, allows investigation of gas breakdown in the high nuvomeg regime. The 35 GHz gyrotron, 150kW, 300ps, allows investigation in a moderate nuvomeg regime. Large gas breakdown plasma densities have been measured, n approx. 100 n sub c. Spectral measurements have been made showing only excitation of molecular bands. Preliminary propagation experiments have also been performed. (Author)

Primary Keywords: Gas Breakdown; Plasma Generators; Air; Molecular Spectroscopy; Emission Spectra; Pulse Generators; Band Spectra; Radiofrequency Power; Molecular Structure; Ka Band; Langmuir Probes; S Band; Magnetrons; Physics

Secondary Keywords: Inverted Magnetrons; Coaxial Magnetrons; Circular Modes; Collision Frequencies; Gyrotrons; NTISDODXA

8632
FAST, VERSATILE POKKELS CELL DRIVER
J.A. Dickens, DC Dohms and D.J. Kuizenga
Lawrence Livermore Lab., Livermore, CA 94550
In 10p-85032, 5p (06/1981).
Availability: DE81024365
NTIS

Vacuum planar triodes, normally used in S-Band radar applications, can also serve as excellent switch tubes in fast, low jitter pulse generators. Laser systems have need of such generators for driving Pockels cells. Development work in this area has resulted in three successive driver designs. The present two-chassis unit will serve as a standard driver in the Nova and Novette laser systems. This assembly is capable of driving nine kilovolts into 75 ohms with three nanoseconds risetime and less than 100 picoseconds short term jitter. Rise and fall times of approximately two nanoseconds are available at half output voltage rating. (ERA citation 06-032744)

Primary Keywords: Lasers; Nova Facility; Pockels Cell; Pulse Generators; Design; Performance; Pulse Rise Time; Pulse Shapers; Switches; Switching Circuits; Triode Tubes

Secondary Keywords: ERDA/700208; ERDA/420300; NTISDE

8633
FIBER OPTIC TELEMETRY SYSTEM FOR LLL HIGH-VOLTAGE TEST STAND
J.P. Richter
Lawrence Livermore Lab., Livermore, CA 94550
No. CDRFA/771227-79, 6p (10/1977).
Availability: UCRL-79688
NTIS

This paper describes the Fiber Optic Telemetry System designed to operate in the hostile particle and electromagnetic radiation environment of the High Voltage Test Stand. It discusses system criteria, components, packaging, and performance. In all tests to date, the system exceeds its design goals with very comfortable margins. It is well advanced into the fabrication stages with all crucial components tested and only straightforward TTL (Transistor Transistor Logic) circuitry to be completed. (ERA citation 03-020715)

Primary Keywords: Data Transmission; Neutral Beam Sources; Optical Equipment; Design; Telemetry; Test Facilities
Secondary Keywords: ERDA/700205; Fiber Optics Transmission Lines; Telemetering Equipment; High Voltage Test Stand; NTISDE

8649
HIGH VOLTAGE PULSE GENERATOR FOR INFLECTOR
S. Asaoaka, M. Mutou and T. Yamakawa
Tokyo Univ. (Japan). Inst. for Nuclear Study.
(05-1979).
Availability: INS-TH-121
NTIS

Recently, an injector linac for INS 1.3 GeV electron synchrotron was reconstructed and the output beam energy of the linac was increased from 9 MeV to 14 MeV. Therefore, in order to increase the inflector voltage a new power supply has been reconstructed. The new power supply consists of a line type pulser and a pulse transformer with step up ratio of 12.5 and generates the pulse of 96 KV height, 6 μs sec width with repetition rate of 22 Hz. It has been operating very well. (Atomindex citation 11-538354)

Primary Keywords: Tokamak Synchrotron; High-voltage Pulse Generators; Hr Supplies; Specifications; Transformers
Secondary Keywords: IN JAPANESE; Foreign Technology; ERDA/430300; NTISINIS; NTISFNUA
Distribution Restriction: U.S. SALES ONLY.

8651
HIGH VOLTAGE, MAGNETICALLY SWITCHED PULSED POWER SYSTEMS
J.P. VanDeender and R.A. Reher
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-0754C, 12p (01/1981).
Availability: DE81025290
NTIS

The principles of magnetic switching are briefly described. Then the results of experiments on the following substantive topics for magnetic switching are presented: material properties and how they relate to switch performance, risetime limitations, and core insulation. Magnetic switching is then evaluated from a system perspective. An idealized pulse power system with 200 kJ of stored energy and a 40 ns output pulse is examined. The insulation and electrical insulation requirements impose limitations on the switches. The cost of the magetically switched system exceeds the cost of the conventional superpower generator system by up to 75%. The potential for reliability, reproducibility, and repetitive pulse capability must be evaluated for each application to offset the increased cost. (ERA citation 06-01652)

Primary Keywords: High Voltage Pulse Generators; Design; Performance; Pulse Techniques; Reliability; Switching Circuits
Secondary Keywords: ERDA/420803; ERDA/420220; NTISPE

8653
HIGH-VOLTAGE AIR-CORE PULSE TRANSFORMERS
G.J. Rohwein
Sandia Labs, Albuquerque, NM 87115
No. SAND-80-0451, 5p (08/1981).
Availability: DE81030999
NTIS

High voltage air core pulse transformers are best suited to applications outside the normal ranges of conventional magnetic core transformers. In general these include charge transfer at high power levels and fast pulse generation with comparatively low energy. When properly designed and constructed, they are capable of delivering high energy transfer efficiency and have demonstrated superior high voltage endurance. The general types designed for high voltage pulse generation and energy transfer applications are described. Special emphasis is given to pulse charging systems which operate up to the multi-megavolt range. (ERA citation 06-033657)

Primary Keywords: High-voltage Pulse Generators; Transformers; Design; Eddy Currents; Electrical Insulation; Electronic Circuits; Equivalent Circuits; Operation; Trigger Circuits; uses

Secondary Keywords: ERDA/420300; NTISDE

8659
LOW FREQUENCY PULSE GENERATOR APPARATUS
D.C. La Pierre
Department of the Air Force, Washington, DC
Patent Application No. PAT-APPL-6-227 557, 13p (08/1981).
Availability: AD-D008 749/4
NTIS

The present invention utilizes one of a plurality of variable capacitors which may be switched into an R-C timing network to establish the pulse repetition rate of the pulse generating circuit. The output of the pulse generator unit is amplified and applied to a predetermined counter unit wherein, upon accumulation of the desired count, an interrupt signal is generated. The interrupt signal which is applied to the pulse generator unit disables the pulse output and thereby allows the generation of a predetermined number of pulses. It is one object of the present invention, therefore, to provide an improved low frequency pulse generator apparatus. It is another object of the invention to provide an improved low frequency pulse generator apparatus wherein the pulse sequence is terminated upon reaching a predetermined pulse count. It is another object of the invention to provide an improved low frequency pulse generator apparatus to provide preset total number of output pulses at a selected pulse rate. It is yet another object of the invention to provide an improved low frequency pulse generator apparatus wherein the preselected pulse counting sequence will resume uninterrupted after an interruption in the counting sequence.

Primary Keywords: Patent Applications; Pulse Generators; Variable Capacitors; Pulse Counters; Counting Methods; Low Frequency Pulse Rate; Output Counters; Pulses; Circuits; Sequences; Inventions; Accumulation

Secondary Keywords: RC Networks; Timing Networks; NTISGAF
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

8661
LOW NOISE, LARGE DYNAMIC RANGE PULSE AMPLIFIER
J. Colas and J.C. Lacotte
Grenoble-1 University, Annecy, France
(03/1980).
Availability: LAPP-80-02
NTIS

We have developed a low noise, high dynamic range low cost amplifier. This amplifier will equip the shower position detector (current dividers readout) and the photomultipliers of the forward electromagnetic calorimeter in the UA1 experiment (CERN anti pp collider). (Atomindex citation 11-566133)

Primary Keywords: Pulse Amplifiers; Shower Counters; Calorimeters; Design; Photomultipliers; Proton-antiproton Interactions

Secondary Keywords: Foreign Technology; ERDA/440104; NTISINIS; NTISFNR
Distribution Restriction: U.S. SALES ONLY.

8664
MPD INTENSE BEAM PULSER
P.J. Turch and I.M. Viskovitsky
Department of the Navy, Washington, DC
Patent Application No. PAT-APPL-6-285 690, 36p (03/1980).
Availability: AD-D008 730/4
NTIS

An MPD intense beam pulser for generating high voltage, intense charged particle beams utilizing an electromechanical energy source and inductive energy storage in combination with a plasma opening switch including a source of directed plasma flow, a diode for accelerating particles in the plasma field, and a plasma flow truncation circuit. In operation, controlled plasma flow is used to conduct current from the energy source in order to supply a desired amount of energy to the magnetic field in the volume surrounding the plasma flow. Truncation of the plasma flow between the electrodes forming the diode then provides a high voltage in a short pulse which generates a high energy charged particle beam. Thus, the magnetic energy store surrounding the diode plasma flow is coupled directly to the intense particle beam. (Author)

Primary Keywords: Patent Applications; Pulse Generators; Plasma Generators; Particle Beams; Magnetic Fields; Electromechanical Devices; High Voltage; Plasmas(Physics); Charged Particles; Beams(Radiation); Plasma Control; Opening(Process); Diodes; Switches; Sources

Secondary Keywords: NTISGP
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

8674

PARTIAL DISCHARGE TESTING OF BULK TRANSFORMER OIL

G.J. Rotwein
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-055IC, 4p (01/1981).
Availability: DE81023663
NTIS

The generation of partial discharges in bulk transformer oil has been investigated experimentally to determine the dominant conditions which contribute to their formation and growth under repetitive impulse stresses. The motivation for conducting these experiments arose from a problem with partial discharges and breakdowns occurring in the insulating oil around the high voltage switch in a continuous running 1.5 MV repetitive pulser system. In this experiment it was found that repetitive stressing caused low level field enhancement around the electrodes which led to bubble formation and eventually partial discharges. There were also qualitative indications of charge accumulation in the oil. Photographic records of numerous shot sequences were used to study the phenomena. (ERA citation 06:023459)

Primary Keywords: Insulating Oils; Transformers; Breakdown; Dielectric Properties; Electric Discharges; Experimental Data; Pulse Generators

Secondary Keywords: ERDA/200300; NTISDE

Distribution Restriction: MICROPOLICHE ONLY AFTER ORIGINAL COPIES ARE EXHAUSTED.

8675

PERFORMANCES OF THE OUTLET PULSE VALVE FOR THE PROTON SOURCE OF THE I-2 LINEAR ACCELERATOR

V.A. Batulin, A.A. Kolomietz and B.K. Kondrat'ev
GKAE Atomic Energy Institute, Moscow, USSR
(01/1979).

Availability: ITEF-97(1979)

NTIS

Described are the design, operating characteristics and work peculiarities of a pulse valve, fixed on the outlet of ion dioplasmatron source of the I-2 linear accelerator for the reduction of gas flow rate. The average gas flow rate constitutes 10 cm exp 3 /h. beam current on the outlet of the injector is 1.2 A, duration of the current pulse is 30 ms, repetition frequency - up to 2 pulses a second. Given are an equation, describing gas regime of the ion source and its solution for the regime with pulsed gas injection in the source and the regime with pulse gas extraction from the source. Considered are the causes of pressure changes in the discharge chamber depending on time for both regimes. Evaluations made on the example of the ion source of the I-2 linear accelerator show that the use of the pulse valve on the outlet permits to essentially decrease average gas flow rate as well as to avoid shortcomings, connected with operation at large volume of the discharge chamber and essential duration of the beam current pulse. (Atomindex citation 11:555263)

Primary Keywords: Proton Sources; Flowsheets; Gas Flow; High Vacuum; Linear Accelerators; Operation; Pulse Generators; Pulse Techniques; Pulses; Specifications; Valves

Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/430301; NTISINIS; NTISFNUR

Distribution Restriction: U.S. SALES ONLY.

8677

POWER FLOW FOR VACUUM-INSULATED INDUCTIVE LOADS

J.P. VanDevender
Sandia Labs, Albuquerque, NM 87115
No. SAND-81-0753C, 3p (01/1981).

Availability: DE81023691

NTIS

The transport of power through a vacuum insulator without flashover and through a short, self-magnetically insulated transmission line without gap shorting severely constrains the stored energy of the inductive load for 50 ns to 300 ns drive times. An electrostatic gap closure mechanism is presented and evaluated. The two close-concentric arcs are then combined with the constraints imposed by magnetic insulation of the electrodes from the cathode and by the vacuum insulator flashover to examine the vacuum power flow from a system's point of view. It is concluded that multimegapulse drivers will be multi-megavolt sources. (ERA citation 06:027997)

Primary Keywords: Inertial Confinement; Pulse Generators; Electrodes; Performance; Power Supplies; Spark Gap

Secondary Keywords: ERDA/700208; ERDA/700211; NTISDE

8680

PRIME POWER TO PULSE CONDITIONING INTERFACE METHODS

J.R. Silvia
AFIT, Wright-Patterson FB, OH
Master's thesis No. AFIT-GE/EE/80D-39, 77p (12/1980).

Availability: AD-2100 627/5

NTIS

AC and DC resonant charging hardware tests were conducted with a 15KW DOD standard 400 Hz generator as prime power. DC resonant charging caused vibration of the generator at the pulsing frequency and failure of the voltage regulator due to the very irregular generator voltage waveform. The input DC voltage to the pulser sagged causing the performance to be lower than expected. An analysis of this problem and the theory to account for this sag is presented. Problems with the triggering of AC resonant charging were not solved in time for this report. The experimental set up of AC resonant charging is presented. AC resonant charging caused no negative impact on the generator which is a great advantage over DC resonant charging. (Author)

Primary Keywords: Electric Generators; Pulse Generators; Direct Current; Ultra-low Frequency; Alternating Current; Input; Input; Waveforms; Voltage; Power; Theses

Secondary Keywords: Resonant Charging; Pulse Conditioning; NTISODDA

8683

PRODUCTION AND FOCUSING OF A HIGH-POWER RELATIVISTIC ANNUAL ELECTRON BEAM

M.U.M Friedman
Cornell University, Ithica, NY 14850
No. LPS-36, 14p (01/1970).

Availability: AD-706 040

NTIS

A new electron beam injection gun has been developed to produce pulsed relativistic electron beams with a power of 10 to the 10th power watts. The annual shield beam propagates in a magnetic field with an elliptical cross section. The longitudinal radius may be controlled by the magnetic field configuration. Typical results obtained with a 4 inch diameter cathode are reported. (Author)

Primary Keywords: Plasma Physics; Electron Beams; Electron Beams_Focusing; Electron Guns; Diodes

8689

PULSED POWER FOR ELECTROMAGNETIC LAUNCHING

M. Cowen
Sandia Labs, Albuquerque, NM 87115
(12/1980).

Availability: SAND-80-1987

NTIS

There are system advantages to producing power for electromagnetic propulsion by pulsed generation rather than by a sequence of generations-storage-switching. The best type of generator for this purpose is the flux compression generator. Different types of flux compression generator which have been developed at Sandia National Laboratories are reviewed and their applications to electric launching are discussed. New experimental facilities for producing more powerful generators are described and cost comparisons are made. (ERA citation 06:022426)

Primary Keywords: Pulse Generators; Railgun Accelerators; Cost; Design; Magnetic Compression; Power Demand; Propulsion; Pulse Concepts; Research Programs; Superconducting Magnets

Secondary Keywords: ERDA/420201; ERDA/700208; NTISDE

8691

PULSED POWER RESEARCH COLLOQUIUM

M. Kristiansen
Texas Tech University, Lubbock, TX 79409
Annual rept. 1 Mar 80-28 Feb 81 (07/1981).

Availability: AD-A105 770/2

NTIS

A Pulsed Power Lecture Series is being conducted by Texas Tech University for the U.S. Air Force. Modular instructional material for use in this lecture series is being developed. Each module is a self-consistent discussion of some aspect of pulsed power technology. The contents range from the very basic (e.g. basic EM field theory) to advanced, modern topics such as magnetic switching. The lectures to date have been given at the Air Force Institute of Technology and the Air Force Weapons Laboratory. The speakers then provide a written text of their lecture, which is edited and published in modular form by Texas Tech University. It is planned to reissue these modules in report or book form at a later date. A total of about 50 modules are planned. Some 30 lecturers have been presented, to date, and about 12 modules have been issued. (Author)

Primary Keywords: Power Supplies; Pulse Generators; Bibliographies; Lectures; Research Management; Symposia; Technology Forecasting

Secondary Keywords: NTISODDXA; NTISODDAF

8697

STRIPLINE MAGNETIC MODULATORS FOR LASERS AND ACCELERATORS

W.C. Munnally
Los Alamos National Labs, Los Alamos, NM 87545
No. LA-UR-81-1553, 5p (01/1981).

Availability: DE81025258

NTIS

The basics of magnetic modulators including magnetic element and circuit considerations as applied to accelerators and lasers, requiring a pulse (1 to 10 kHz), high voltage (50 to 500 kV), short pulse (50 to 100 ns) are discussed. The scaling of energy losses and switching parameters with material are included. (ERA citation 06:027548)

Primary Keywords: High-voltage Pulse Generators; Accelerators; Design; Lasers; Magnets

Secondary Keywords: ERDA/420800; NTISDE

8699

SUB-NANOSECOND JITTER, REPETITIVE IMPULSE GENERATORS FOR HIGH RELIABILITY APPLICATIONS

G.J. Krausse and W.J. Sargeant
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-810659-3, 7p (01/1981).

Availability: LA-UR-81-1655

NTIS

Low jitter, high reliability impulse generator development has recently become ever increasing importance for developing nuclear or silica and weapons applications. The research and development of very low jitter (c. 30 ps), multikilovolt generators for high reliability, minimum maintenance trigger applications utilizing a new class of high-pressure tetrode thyratrons now commercially available are described. The overall system design philosophy is described followed by a detailed analysis of the subsystem component elements. A multi-variable experimental analysis of this new tetrode thyratron was undertaken in a low-inductance configuration, as a function of externally available parameters. For specific thyratron trigger conditions, rise times of 10 ns into 6.0 ohm loads were achieved at jitters as low as 24 ps. Using this database, an integrated trigger generator system with solid-state front-end is described in some detail. The generator was developed to serve as a master trigger generator for a large neutrino detector installation at the Los Alamos Meson Physics Facility. (ERA citation 06:024100)

Primary Keywords: Flash Tubes; High-voltage Pulse Generators; Capacitive Energy Storage Equipment; Capacitors; Design; Electronic Circuits; Neutrino Detection; Pulse Generators; Pulse Rise Time; Thyratrons; Trigger Circuits

Secondary Keywords: ERDA/440104; ERDA/420800; NTISDE

8707

TEST STAND FOR MAGNETRON H NEGATIVE ION SOURCE AT IPP-MAGOYA

H. Okamura, T. Kuroda and A. Miyahara
Nagoya University, Nagoya, Japan
No. IPPJ-1-33, 22p (02/1981).

Availability: N01-25811/3

NTIS

Test facilities for the development of magnetron H(-) ion source consists of the vacuum system, power supplies, diagnostic equipment, and their controlling electronics. Schematics are presented and relevant items described including the source control, optical links, the charged pulse forming network, the extractor power supply, magnet power supply, temperature control of the cesium feeder, and the pulsed valve driver. Noise problems and diagnostics are also considered.

Primary Keywords: Ion Sources; Magnetrons; Negative Ions; Test Facilities; High Voltages; Optical Waveguides; Pulse Generators; Temperature Control; Vacuum Chambers

Secondary Keywords: Foreign Technology; NTISNASA; NTISFNJA; NTISNASA; NTISFNJA

213

THYRATRON MARX HIGH VOLTAGE GENERATOR

T.F.J. Emanzky
Department of the Army, Washington, DC
Patent Application No. PAT-APPL-6-224 604, 16p (02/1981).
Availability: AD-008 183/6
NTIS

This invention relates to a high voltage pulse generator of the Marx type, in which capacitors are charged in parallel and discharged in series. Amongst the many techniques for producing high voltage pulses, the Marx generator is probably the best known and most widely used. For the combination of short risetime and low output impedance (i.e., high power), large energy, high efficiency and waveform flexibility -- the Marx principle is peerless. In response to the recognizer need for a Marx generator capable of high repetition rate, I have investigated Marx circuitry using modern thyratrons as the switching elements. Because of the relatively high voltage trigger requirements of spark gaps, Marx circuitry developed for these devices has concentrated on achieving a balance between hold off times and triggering schemes that produce an orderly erection mode, so the predictable output pulse sequence is realized. High repetition rate capability, low voltage trigger requirements, and high reliability are well known thyratron characteristics when used in a conventional manner. However, particular problems arise with the use of thyratrons in a Marx circuit, such as both external and internal arcing, because of progressively increasing overvoltages.

Primary Keywords: Patent Applications; Pulse Generators; Transformers; Winding; Thyatrons; Switching; Secondary; Pulses; Inductors; Output
Secondary Keywords: MARX Generators; NTISOPA
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND POSSIBLY FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

VARIABLE PULSE-WIDTH GENERATOR

L.E. BOLLINGER
Ohio State University, Columbus, OH
(11/1954).

Availability: AD-051 660/9
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Recording Systems; Rocket Engines; Timing Circuits; Design; Rockets; Tests
Secondary Keywords: NTISODDXD; NTISODDXB
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE NC MICROFICHE.

6TH INTERNATIONAL TOPICAL CONFERENCE ON HIGH-POWER ELECTRON AND ION-BEAM RESEARCH AND TECHNOLOGY

J.R. Neighbours
Office of Naval Research, London, UK
Conference rept. No. ONSL-C-6-81, 16p (10/1981).
Availability: AD-A108 353/4
NTIS

The Fourth International Topical Conference on High-Power Electron and Ion-Beam Research and Technology program included electron and ion beam generators, beam transport, plasma heating and free electron lasers. This report is principally about foreign research results. It also contains a list of speakers and the topics discussed.
Primary Keywords: Electron Accelerators; Ion Accelerators; Heating; Plasmas(Physics); Pumping(Electronics); Electrical Lasers; Relativity Theory; Electron Beams; Ion Beams; Free Electrons; High Power Pulse Generators; Symposia; France
Secondary Keywords: Cooling Technology; Free Electron Lasers; Inertial Confinement Fusion; Marx Generators; Power Density; NTISODDXA; NTISPHUK; NTISPHZ

A HALF MEGAWATT PULSE FORMING NETWORK (PFN)

J.E. Creedon and R.A. Fitch
ECOM, Port Monmouth, NJ 07043
Research and development technical rept. No. ECOM-4494, 8p (04/1977).
Availability: AD-A039 709/151
NTIS

A lightweight half megawatt average power pulse forming network (PFN) designed a store 4 kilojoules (kJ) at 40 kJ/shot has been developed. The energy storage system produces a 10 microsecond pulse at a repetition rate of 125 hertz and has a one ohm impedance. It is designed to operate adiabatically for durations of 60 seconds. A lifetime capability of over 400,000 pulses has been demonstrated.
(Author)

Primary Keywords: Pulse Generators; Energy Storage; Capacitors; Pulse Modulation; Networks; Power
Secondary Keywords: NTISODDXA

(ELECTROMAGNETIC FIELD GENERATION; PARTICLE BEAMS)

(Electromagnetic Generation)

IMPROVED DESIGN AURORA MODIFICATION PROGRAM (IDAMP)
S.E. Graybill, A.G. Stewart, G.A. Huttlin, D.A. Knittaker and K.G. Keris

Harrington Diamond Labs, Adelphi, MD 20783

NDL Report No. NDL-SR-81-8 (12/1981).

Availability: NDL-SR-81-8

Harrington Diamond Labs

The AURORA High-Intensity Flash X-Ray Facility could be modified to provide a high-energy, medium (2 to 10 ohm) impedance, multiterawatt pulse power source. This Improved Design AURORA Modification Program (IDAMP) could be achieved with only modest restructuring of the existing AURORA hardware. A pulsed transformer, oil, air, and water cooling and water cooled thermal insulation medium, a power output of 25 MW in a pulse of <5 MV amplitude and approximately 140 ns FWHM is feasible in either positive or negative polarity. This power source could be applied to high-intensity electron, ion, and microwave beams. 0 Refs.

Primary Keywords: High-Intensity Electron Beam; High-Intensity Ion Beam; Source-Region Electromagnetic Pulse; AURORA

Source; Pulse; Pulse Source; Pulse Source

LARGE OUTPUT MILLIMICROSECOND IMPULSE GENERATOR USING ELECTROMAGNETIC SHOCK WAVES

J. Oravec, P. Gabec and F. Varsik
FID-Wright-Patterson AFB, OH
No. FID-ID(RS)I-2207-75, 13p (12/1975).
Availability: AD-A020 152/557
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Electromagnetic Wave Propagation; Shock Waves; Electric Discharges; Plasmas(Physics); Semiconductors; Magnetic Fields; Permeability(Magnetic); Nonlinear Systems; Czechoslovakia; Translations
Secondary Keywords: Seignette Electronics; NTISODDXA; NTISODDAF

OPERATION OF A 300 KV, 100 MHZ, 30 KW AVERAGE POWER PULSER

M.T. Buttrus and G.J. Rohrman
Sandia Labs, Albuquerque, NM 87113
No. CONN-780676-1, 6p (01/1978).
Availability: SAND-78-093C

Applications for efficient and reliable pulse power systems with long lifetimes (>10 exp 6 shots) are foreseen for electron beam generators, heavy ion accelerators and lasers leading eventually to indefinitely continuous fusion reactors. These systems will have to be capable of continuous operation for sustained periods without requiring major maintenance or repair. High operating efficiency will be required not only to minimize power consumption but also to avoid heat generation and consequent damage to components. The system described in this paper represents an initial effort to develop an efficient energy handling high voltage pulser to study the problems of long-life components. (ERDA citation 04 00204.)

Primary Keywords: Linear Accelerators; Power Supplies; Design; Efficient; Electron Beam Injectors; Electron Beam Injectors; Electron Sources; Inertial Confinement; Lifetimes; Pulse Generators; Thermonuclear Reactors; Transformers

Secondary Keywords: EPDA/00203; ERDA/700208; High Voltage; NTISDE
Distribution Restriction: MICROFICHE COPIES ONLY. MICROFICHE COPIES ONLY

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

A MODEL FOR DC INTERRUPTION IN DIFFUSE VACUUM ARCS
S.E. Childs and A.M. Greenwood
Rensselaer Polytechnic Institute, Troy, NY 12181
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 289-294 (12/1980).

A theoretical model for current interruption in a diffuse vacuum arc with DC commutation is described. Before current zero the interelectrode plasma is modeled as an ion-neutral fluid through which electrons are flowing. After current zero a positive ion sheath grows into the plasma from the former anode, driven by the transient recovery voltage. Using the basic laws of conservation, the decay of the plasma during commutation is evaluated numerically, enabling the post-arc current and the electric field at the former anode and the positive sheath to this electrode after current zero to be calculated. For copper electrodes, with a commutation time of 35 microseconds, the ion density and velocity at current zero are 23 percent and 15 percent of their respective steady state values. The calculated post-arc currents of tens of amps are in good agreement with experimental data. The post-arc data generated with this model can be used to study reconnection mechanisms and the interrupting capability of different contact materials. 19 Refs.

Primary Keywords: Vacuum Arc; Diffuse Arc; Fluid Model; Ion Sheath; DC Current Interruption; Copper Electrodes; Theory
COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

(ENERGY CONVERSION, THERMAL)

(Magnetohydrodynamics)

ANALYSIS OF THE NET METHOD OF CALCULATING THE ELECTRICAL CHARGE/CTR015-1/5 OF THE CHANNEL IN A MHD GENERATOR
A.A. Bulygina, Yu. Gusev, V.I. Pishchikov and S.I. Pishchikov

Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 123-127 (02/1981).
Transl. from "Teplofizika Vysokhikh Temperatur" 19, 158-163 (January, February 1981).

The integral electrical parameters of the channels in MHD generators have been calculated by means of electrical networks consisting of active and passive components. If there is substantial transverse inhomogeneity in the plasma parameters, the error in the calculation is determined by the number and dimensions of the net cells in the transverse direction. A simplified model has been used to estimate the current densities in the channel and compared with calculations on channel No. 1 in the U-25 apparatus. 8 Refs.

Primary Keywords: MHD Generators; Circuit Modeling; Error Analysis; Theory; Comparison With Experiment
COPYRIGHT: 1981 PLENUM PRESS. REPRINTED WITH PERMISSION

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

AN INVESTIGATION OF THE TIME LAG OF THE DISCHARGE IN THE ELECTRICAL BREAKDOWN OF VACUUM GAPS

O.M. Nasirov and S.M. Khalilov
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physical Technical Physics, Vol. 9, No. 3, pp 377-379 (09/1964).
Transl. From: "Zhurnal Tekhnicheskoi Fiziki" 34, 485-487 (March 1964).

The time lag of the discharge in the electrical breakdown of vacuum gaps of 0.1, 0.3, 0.5, and 1.0 mm with different degrees of overvoltage on the gap is investigated. It is shown that the time lag of the discharge in the breakdown of vacuum gaps decreases almost linearly with increase in the degree of overvoltage on the gap. With an equal and small degree of overvoltage on the vacuum gap, the time lag of the discharge varies nonlinearly with the interelectrode distance. In the region of interelectrode distances 0.3-0.5 mm there is a sharp increase in the time lag with increase in the interelectrode distance. 5 Refs.

Primary Keywords: Vacuum Breakdown; Formative Time Lag; 0.1-1.0 mm Gap; Delay vs Voltage Measurement; Dependence On Gap Spacing
COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

- 8916**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
ANODE SHEATH GROWTH AND COLLAPSE IN A HOLLOW-ANODE VACUUM ARC
R. Dollinger, D.R. Dettman, J.L. Lee, A.S. Gilmour Jr., D.P. Malone and
P.R. Schwartz
State University of New York at Buffalo, Buffalo, NY 14226
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 302-307
(12/1980).
- Experimental diagnostics in a hollow-anode vacuum arc device have shown that the repetitive growth and collapse of an anode sheath is responsible for observed tens-of-kV voltage spikes. A dynamic model of device operation based on circuit effects and a time varying quasi-Chid-Langmuir sheath is presented. The scaling of the repetition rate with respect to cathode material is discussed. The device is being investigated for use as a current limiter for approximately 10 micro-pulses. 12 Refs.
- Primary Keywords:** Vacuum Breakdown; Hollow Anode; Anode Sheath Modulation; Voltage Spikes; Child-Langmuir Sheath; Theory; Comparison with Experiment
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION
- 8917**
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)
(Gas, Electrical; Gas, Recovery; Mechanical)
ARC-GAS FLOW INTERACTIONS IN A DOUBLE-NOZZLE FLOW SYSTEM
W. Tiemann
Siemens Research Center, 8520 Erlangen, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 368-375
(12/1980).
- The physical phenomena in cold and arc heated double-nozzle gas flows have been investigated for SF₆/sub 6% by interference and shadow methods. The cold-flow phenomena are discussed as a basis for a better understanding of the arc-gas flow interactions, and their interference patterns are clearly interpreted. The observed fringes, which also can be calculated theoretically, are due to a local flow velocity. In the case of arc heated flows a sharp distinction is made for the first time between different types of arc-gas flow interactions. At low peak currents the interference pattern still shows a cold gas flow around the arc. At higher current levels a fringe system, which indicates a density reduction, expands into the volume around the nozzles; however, the flow is still directed towards the gap between the nozzles. In contrast to this case the strongest form of interaction is characterized by the appearance of arc heated gas, which flows turbulently back into the high-pressure volume. The radial temperature distribution for a special arc has been calculated theoretically and is discussed in detail. 27 Refs.
- Primary Keywords:** Circuit Interruption; Gas Blast Circuit Breaker; Double-nozzle Configuration; Cold Flow; Arc-heated Flow; Holographic Interferometer Diagnostic; Shadowgraphy
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION
- 8919**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
BEHAVIOR OF A HIGH CURRENT VACUUM ARC BETWEEN HOLLOW CYLINDRICAL ELECTRODES IN A RADIAL MAGNETIC FIELD
R.I. Boxman, E. Gerby and S. Goldsmith
Tel Aviv University, Tel Aviv, Israel 69978
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 308-313
(12/1980).
- Experimental observations were conducted on the behavior of a high current vacuum arc on cylindrical electrodes in a radial magnetic field. The arc was sustained between the ends of two cylindrical Cu electrodes, 56 mm diam and 1.5 mm wall thickness separated by 5 mm. Arc current pulses with peak values in the range 4-15 kA with a half amplitude full width (HAFW) duration of 8 ms were investigated with rapid magnetic fields proportional to the instantaneous current with proportionality constants of 4.0 and 6.5E-6 T/A. The arcs were photographed simultaneously with a streak camera and by a high speed framing camera and the arc voltage was recorded on a digitizing transient recorder. The results indicated that the arc in this geometry, both with and without an imposed radial magnetic field, can be characterized by three development stages: a) arc formation; b) diffuse arc along the electrode perimeter; and c) simultaneous existence of several concentrated arc columns. When a radial magnetic field was imposed two changes were noted: 1) the 1-dimensionsal somewhat more distributed in time and space number of concentrated columns were observed; and 2) they were 2-dimensionsally averaged; and 3) the constricted columns were in the 4 x 8 direction with velocities in the range 5-15 m/s. 7 Refs.
- Primary Keywords:** Vacuum Arc; Cylindrical Geometry; Radial Magnetic Field; Copper Electrodes; Arc Development; 2-d Models; Photography; Transient
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION
- 8920**
(BREAKDOWN STUDIES)
(Gas, Electrical)
CALCULATION OF THE TEMPERATURE IN A CONDUCTIVE TRACK OF AN ARC ON THE SURFACE OF A MAGNET-BLAST CHUTE
A. Tsaf
Ben Gurion University of The Negev, Beer-Sheva, Israel
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 455-460
(12/1980).
- The space and time temperature distribution is analyzed for a conductive track of a high current arc that was burned in the insulating channel of a magnet-blast chute. The thermal conditions in absence of boiling and ablation were considered by a combination of the methods of continuous and instantaneous energy sources, when the energy consumption for the phase transition is assumed to be uniform. The purpose of such analysis was a study of possibilities for using the additional energy absorption capacity of chutes by increasing the permissible temperature of their walls up to the boiling point. 10 Refs.
- Primary Keywords:** Magnet-blast Chute; Arc Quenching; Insulation Arc Track; Arc Rejection
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION
- 8922**
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Vacuum, Electrical; Gas, Electrical, Mechanical; Gas, Recovery; Vacuum, Recovery)
CURRENT CHOPPING INTRODUCED BY ARC COLLAPSE
W.M.C. Van Den Heuvel
Eindhoven University of Technology, Eindhoven, Netherlands
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 324-331
(12/1980).
- The intensive cooling by a moving gas can cause violent elongations and curvatures of the circuit breaker arc, especially when small currents are interrupted. During the elongation the arc voltage increases rapidly. This introduces a breakdown across a smaller distance by short circuiting a part of the arc. Here, such a breakdown is called arc collapse. The abrupt decrease in resistance and arc voltage may give rise to an oscillating discharge of the circuit breaker parallel capacitance into the arc path. This oscillation can force the main current to zero and thus cause current chopping. In this paper the kind of current chopping is studied and compared with chopping by instability oscillation. It is theoretically explained why these independent origins for chopping produce the same chopping levels. 17 Refs.
- Primary Keywords:** Vacuum Breakdown; Gas Breakdown; Circuit Breaker; Current Chopping; Arc Motion; Theory
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION
- 8924**
(BREAKDOWN STUDIES)
(Gas, Electrical)
DETERMINATION OF TEMPERATURE, VELOCITY DISTRIBUTION, AND POPULATION DENSITIES OF NEUTRAL HELIUM BY MEANS OF LASER LIGHT TUNED ON ATOMIC RESONANCES
M. Odenthal and J. Uhlenbusch
Universität Düsseldorf, Düsseldorf, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 431-436
(12/1980).
- Temperature, velocity distribution, and population density of neutral Helium in the 2-³S_{1/2} level in discharges of different current and pressure values are measured by absorption dispersion, and resonance scattering experiments. The light source for these investigations is a tunable dye laser with linewidth of 2 MHz. The measurements show that there is a good mutual agreement among each of these methods and that these diagnostic methods are very easily adapted to investigate discharges with low densities of population, where Doppler-broadening mechanisms predominate. In addition, the experimental values of the index of refraction are compared with the linear dispersion theory confirming the predicted theoretical profiles. 7 Refs.
- Primary Keywords:** Helium Breakdown; Neutral Helium Population; Several Diagnostics; Good Agreement
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION
- 8925**
(BREAKDOWN STUDIES)
(Gas, Microwave)
DISTRIBUTION FUNCTION AND MEAN ENERGY OF ELECTRONS IN A HIGH-FREQUENCY MOLECULAR-GAS DISCHARGE
A.V. Evsukov and A.V. Elestik
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 7-12 (02/1981).
Trans. From: Tekhnika Vysokikh Temperatur 19, 6-15
(January-February 1981).
- On the basis of solving the Boltzmann kinetic equation for electrons in a high-frequency discharge, taking account of elastic and inelastic electron-molecule collisions, and also the diffusional drift of the electrons to the wall of the discharge tube, it is established that, from the viewpoint of electron energy balance in a discharge, the given type of different ionization mode may be 1) 2-dimensionsal, i.e. a core durable fraction of the energy introduced in the discharge is consumed in exciting vibrational degrees of freedom of the molecules, while in the other the basic mechanism of electron energy loss is associated with elastic electron-molecule collisions. The conditions for the discharge to pass from one type to the other are obtained, and the dependence of the mean electron energy on the discharge parameters is calculated. 7 Refs.
- Primary Keywords:** High Frequency Gas Breakdown; Boltzmann Equation; Electron-molecule Collision; Electron Diffusion; Two-Dimensions; Theory
- COPYRIGHT:** 1981 PLENUM PRESS. REPRINTED WITH PERMISSION
- 8927**
(BREAKDOWN STUDIES)
(Gas, Electrical)
EFFECT OF PLUG FLOW ON THE STABILITY OF TWO-DIMENSIONAL ARCS
I.M. Cohen, P.S. Ayvazyan and T. Sudararajan
University of Pennsylvania, Philadelphia, PA 19104
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 390-394
(12/1980).
- Steady solutions to the governing equations that describe fully two-dimensional arc plasmas in a plug flow have been obtained. The stability of these steady solutions is investigated by calculating the transient created when infinitesimal changes in the electrode potentials are imposed. Comparisons are made with solutions obtained using a one-dimensional electric field. We find that with increasing blowing (faclet number) the one-dimensional electric field solutions yield increasingly inaccurate results for higher currents. The stability results conform to those given by the classical Kaufmann criterion. We find that convection tends to reduce and eventually to eliminate the declining branch of the current-voltage characteristic. The presence of convection promotes axial temperature gradients in the arc and hastens the transition from the unstable (declining) branch to a stable (increasing) branch of the current-voltage characteristic. 9 Refs.
- Primary Keywords:** Arc Stability; Plug Flow; 2-d Arc Model; Comparison With 1-d Model; Theory; Comparison With Experiment
- COPYRIGHT:** 1980 IEEE. REPRINTED WITH PERMISSION

515

8928
(BREAKDOWN STUDIES)
(Electrodes)

EFFECT OF SELF-MAGNETIC FORCES ON THE ANODE MECHANISM OF A HIGH CURRENT DISCHARGE

H. Hugel

Institut für Technische Physik, DFVLR, Stuttgart, FRG

IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 437-442

(12/1980).

When a DC discharge is operated between a central cathode and a ring-shaped anode at currents up to 6E3 A and pressures on the order of a few Torr, the stable discharge regime is found to be limited. The anode fall voltage is determined experimentally from calorimetric and potential measurements. In a wide range of operating conditions its variation correlates well with the parameter $J_{\text{A}}^{\text{sup}} 2 / \text{d}x / \text{dt}$, where J_{A} current, $\text{d}x / \text{dt}$ mass flow rate through the discharge. With increasing values of $J_{\text{A}}^{\text{sup}} 2 / \text{d}x / \text{dt}$, divided by $\text{d}x / \text{dt}$, the anode fall increases continuously from small negative values, through zero, and up to moderate positive values. Thus within a small increment of $J_{\text{A}}^{\text{sup}} 2 / \text{d}x / \text{dt}$, it jumps to values on the order of the ionization potential of the gas. A theoretical two-dimensional description of the flow field indicates that the self-magnetic forces, which are proportional to $J_{\text{A}}^{\text{sup}} 2 / \text{d}x / \text{dt}$, pinch the gas towards the discharge axis, thereby leading to particle starvation in the vicinity of the anode. Based upon the results of this study it is shown that, as a consequence of the altering boundary conditions, which are characterized by the parameter $J_{\text{A}}^{\text{sup}} 2 / \text{d}x / \text{dt}$, the anode responds by adopting different operating modes. Existing theories yield values for the anode fall which are in good agreement with experimental data. 27 Refs.

Primary Keywords: Gas Breakdown; Low Pressure Discharge; Anode Fall; 6 KA Current; DC Arc; Radial Discharge; Experiment; Theory; 2-d Model; Several Discharge Modes

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8931
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Electrodes; Gas Gaps, Materials)

EROSION OF CATHODE MATERIAL IN A PULSED DISCHARGE BETWEEN PARALLEL ELECTRODES

R. Basharov, E.N. Mel'kin, O.A. Govrilovskaya and E.S. Trekhov

Moscow Physical Engineering Institute, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1383-1390

(04/1968).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1889-1896 (October 1967) Results are presented of a study of the erosion of a copper cathode in a pulsed discharge. The effects of the condition of cathode surface and of the kind and pressure of gas on the character of erosion and on the surface current density were investigated. It was established that the condition of the cathode surface is of great importance. A hypothesis is proposed about the cause of this phenomenon. The experimental data on cathode-material erosion are compared with the results of calculations based on various theories. 14 Refs.

Primary Keywords: Cathode Erosion; Copper Cathode; Cathode Surface Condition; Gas Gap; Variable Gas Pressure; Various Gases; Experiment; Comparison With Theory

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8932
(BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Vacuum, Electrical; Mechanical; Vacuum, Recovery)

EXPERIMENTAL INVESTIGATION OF LOW-CURRENT VACUUM ARC INSTABILITIES

K. Frohlich

Technical University of Vienna, Vienna, Austria

IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 319-325

(12/1980).

The instabilities of 50 Hz low-current vacuum arcs and chopping phenomena were investigated in a test circuit where current was limited either by a resistor or an inductance. Employing a special test method which was developed for statistical evaluation, current zeros were measured oscillating with a time sweep of 50 to 100 ns/div for durations of <60 div. The effects observed are equivalent to those obtained with other methods. It was found that each chopping process is initiated by a partial arc extinction (which is a rule occurs within less than 10 ns). One of the dominant factors of the whole process is the speed of recovery of the contact material (copper contact) showed a much faster recovery and thus higher chopping currents than contacts of copper-tungsten. Furthermore, the current value at which the first instability occurs was measured as well as the corresponding chopping current. Both values were evaluated statistically. In agreement with previous findings the occurrence of the first instability turned out to be independent of the capacitance parallel to the switching gap. However, the chopping current showed a significant dependence on the capacitance, as is also known from similar investigations. 15 Refs.

Primary Keywords: Vacuum Breakdown; Vacuum Interrupter; Low-current Breakdown; Current Limiting Resistor; Power Line Frequency; Instability; Current Chopping; Several Contact Materials

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8933
(BREAKDOWN STUDIES; SWITCHES, OPENING; BREAKDOWN STUDIES)
(Gas, Electrical; Mechanical; Gas, Recovery)

EXPERIMENTAL INVESTIGATION ON ARC PHENOMENA IN SF₆/SUB 6/ PUFFER CIRCUIT BREAKERS

A. Kobayashi, S. Yanabu, S. Yamashita and Y. Ozaki

Toshiba Corp., Kawasaki, Japan

IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 339-343

(12/1980).

A detailed observation of an arc in a model puffer-type SF₆/SUB 6/ gas circuit breaker in the current range between 10 and 50 kA (rms) has been carried out. It was found that the arc column remained stable on the center axis during the high-current region, then became turbulent near current zero. It was found that the time interval during which the turbulent arc was observed decreased with increasing values of the peak current. These phenomena indicated that the thermal effects of high-current arcs remain even at current zero. It also was observed that the arc diameter at the nozzle throat outlet was smaller than that at the throat (29 mm), even at current as high as 70 kA (instantaneous), and that the boundary of gas flow at a downstream region had a very large diameter when the arcs were present. However, around current zero the boundary diameter became as small as that without arc. 4 Refs.

Primary Keywords: Gas Blast Circuit Breaker; SF₆/SUB 6/ Gas; 50 kA Current; Arc Instabilities; Thermal Effects

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

216

8935
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

FIELD EMISSION FROM VACUUM-DEPOSITED METALLIC FILM AND ITS ROLE IN ELECTRIC BREAKDOWN IN VACUUM

R.H. Sudan and F. Gonzalez-Perez

Cornell University, Ithaca, NY 14850

Journal Of Applied Physics, Vol. 35, No. 7, pp 2269-2276 (07/1964).

An experiment to study the field emission of vacuum gaps has been performed. Copper vapor from an external arc is allowed to condense on a preconditioned tungsten filament to study the state of aggregation of the copper deposit. Field emission sites are observed photographically and are found to be elliptical in nature. 6 Refs.

Primary Keywords: Field Emission; Metallic Film; Emission Centers

COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8937
(SWITCHES, OPENING; BREAKDOWN STUDIES)
(Mechanical; Gas, Recovery)

FREE RECOVERY OF THE GAS-BLAST ARC COLUMN

E. Richley and T. Tuna

Carnegie-Mellon University, Pittsburgh PA 15213

IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 405-410

(12/1980).

The decay of the temperature, velocity, and radius of the extinguished gas-blast arc in SF₆/SUB 6/ and N₂/SUB 2/ is theoretically investigated. The conservation equations for mass, momentum, and energy in integral form and on the axis describe the decay process. Local thermodynamic equilibrium (LTE) is taken to apply for the determination of the material and transport properties of the gases. The influence of the hot gas mantle on the decay of the arc column is taken into account. It is found that the temperature decay of the column in N₂/SUB 2/ is much faster than in SF₆/SUB 6/. Thus the superior dielectric strength of the SF₆/SUB 6/ column over that of N₂/SUB 2/ cannot be explained solely by the temperature decay rates. The predicted rate of decay of the column radius in N₂/SUB 2/ is found to agree well with experimental results. The results of this study are expected to be of value in the determination of the dielectric breakdown characteristics of extinguished arcs. 16 Refs.

Primary Keywords: Gas Blast Circuit Breaker; SF₆/SUB 6/ Blast; N₂/SUB 2/ Blast; Air Temperature; Arc Radius; Theory; Magnetohydrodynamic Model

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8938
(BREAKDOWN STUDIES)

(Gas, Electrical)

HIGH-CURRENT DISCHARGE IN A DENSE PLASMA SOURCE

A.I. Bogorod, S. Slobodin, V.P. Levaichenko and F.O. Rubberg

All-Union Institute of Plasma, Moscow, USSR

Soviet Physics-Technical Physics, Vol. 22, No. 1, pp 68-75 (01/1977).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 121-133 (January 1977).

High-current discharges in dense-plasma sources are studied. The working gases are hydrogen, helium, nitrogen, argon, and lithium hydride vapor. The initial hydrogen density is varied over the range 1E-4 - 4E-3 g/cm³; the current is varied over the range 30-300 kA, the rate of the rise of the current is varied over the range dI/dt approximately 1E7 - 1E9 A/sec, and the lifetime over the range 0.5-70 msec. In hydrogen the discharge is turbulent and fills the entire discharge volume. The mechanism by which energy is transferred from the arc to the gas in the discharge chamber is discussed. The energy balance in a turbulent hydrogen arc is examined. 16 Refs.

Primary Keywords: Gas Breakdown; 30-300 kA Current Range; High dI/dt; Secondary Keywords: Plasma Source; Several Gases; Energy Balance

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8939
(BREAKDOWN STUDIES)

(Electrodes)

IMPORTANCE OF INSULATING INCLUSIONS IN ARC INITIATION

R. Hancox

Atomic Energy Research Establishment, Harwell, Berkshire, UK

British Journal Of Applied Physics, Vol. 11, pp 468-471 (10/1960).

The initiation of arcs on a metal surface in contact with a plasma (ion density about 1E16 ion/cm³) has been studied with metal specimens known to contain microscopic alumina inclusions. The specimens were biased negatively with respect to the plasma, and for voltages above 300 V the time lag before arcing occurred was inversely proportional to the positive ion current. The time lag increased rapidly with decreasing voltage. Arcing was also independent of the nature of the ions and the pressure of neutral gas in the plasma. These results are consistent with the initiation of the arcs by dielectric charging and breakdown of the inclusions. 9 Refs.

Primary Keywords: Breakdown; Electrode Insulation Inclusions; Alumina Inclusions; Dielectric Charging; Electrode-plasma Contact; Delay Measurement

Secondary Keywords: C.T.R. Tube

COPYRIGHT: 1960 TMF INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8940
(BREAKDOWN STUDIES)

(Electrodes)

INFLUENCE OF THE COPPER ELECTRODE SURFACE ON INITIAL ARC MOVEMENT

K. Poessl

Technical University of Vienna, Vienna, Austria

IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 443-448

(12/1980).

To investigate the influence of the copper electrode surface condition on the initial arc movement and the immobility time respectively, a special experimental device was developed. It permits to keep constant, or vary those parameters independently, which influence the initial movement, i.e., arc current (170 A), magnetic flux density (10-1000 x 1E-4 T), electrode distance (1 mm), and surface condition (oxide-film thickness, roughness). The magnetic field can be applied at an angle, which can be varied independently of the arc current. The arc is initiated by means of a dielectric breakdown in order to eliminate the ignition effects, such as liquid and vaporizing electrode material. The most striking result of the experiments was that only arc movements of various velocities, but no absolute immobility was measured. This observation is due to the elimination of ignition effects as well as to the use of an adequate sensitive measuring technique. Impeded arc motion characterized by shorter or long lasting creeping (v approximately <= 3 m/s) occurs, if certain magnetic flux density or copper surface conditions do not permit velocities v>10 m/s or if the electrode surface is thermally prestressed by a deliberately standing arc. 19 Refs.

Primary Keywords: Breakdown; Copper Electrodes; Electrode Surface Effects; External Magnetic Field; Independent Parameter Variation; Arc Velocity

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8941
(BREAKDOWN STUDIES; SWITCHES, OPENING)

(Vacuum, Electrical; Vacuum Gaps, Magnetic Field)
INTERACTION BETWEEN VACUUM ARCS AND TRANSVERSE MAGNETIC FIELDS WITH APPLICATION TO CURRENT LIMITATION
N.B. Entage, C.W. Kimblin, J.G. Gorman, F.A. Holmes, J.V.R. Heberlein,
R.E. Voshell and P.G. Slade
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 314-319
(12/1980).

The interaction between diffuse vacuum arcs and magnetic fields applied transverse to the electrode axis has been investigated both theoretically and experimentally. For arc currents < 60 kA, Hall electric fields, generated by the interaction, blow the plasma out of contact with the electrodes and since the arc voltage in the presence of a Hall capacitor, the arc current falls to zero and the arc is extinguished. For arc currents of 6 to 15 kA, arc extinction can be achieved with an oscillatory magnetic field; during such extinctions the arc voltage remains in phase with the magnitude of the field. Arc extinction via magnetic field/vacuum arc interaction could have applications to AC-current limiters and DC breakers. The fault current limiter application is discussed in this paper. 17 Refs.

Primary Keywords: Vacuum Breakdown; Diffuse Vacuum Arc; Transverse Magnetic Field; Hall Effect; Opening Switch

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8942
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)

(Gas, Electrical; Gas, Recovery; Mechanical)
INTERACTION CAPABILITY OF GASES AND GAS MIXTURES IN A PUFFER-TYPE INTERRUPTER

A. Lee and L.S. Frost
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 320-327
(12/1980).

SF₆/SF₆/gas has been widely used in arc interruption applications for the past 20 years. Reported here is a systematic, comprehensive effort to search for and evaluate gases and gas mixtures suitable as an arc interruption medium potentially superior to SF₆/SF₆/. The search began with several hundred gases, narrowed down to about forty, and finally fifteen gases and gas mixtures were evaluated in a full size puffer-type interrupter under 60-kHz high-power conditions. The results show that SF₆/SF₆/ stood out as having the best interruption capability with several mixtures having approximately 80 percent of SF₆/SF₆/'s performance. 8 Refs.

Primary Keywords: Gas Blast Circuit Breaker; Several Gas Mixtures; Relative Interruption Capability; Performance Test; Gas Selection Criteria

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8944
(SWITCHES, CLOSING)

(Gas Gaps, Optical)
KRF LASER-TRIGGERED SF/SUB 6/ SPARK GAP FOR LOW JITTER TIMING
W.R. Rapoport, J. Goldhar and J.R. Murray
Lawrence Livermore Lab., Livermore, CA 94550
IEEE Transactions On Plasma Science, Vol. PS-8, No. 3, pp 167-170
(09/1980).

KRF laser-triggered spark gaps exploit the high DC-dielectric strength and low ultraviolet (UV) breakdown threshold of SF₆/SF₆/gas. Detailed measurements using a DC-charged pulser demonstrate subnanosecond jitter for switching a 0.5-cm gap operated at 80 kV with 7 mJ in 20 ns of 248-nm KRF radiation. A 200-kV pulse-charged 0.7-cm gap gives similar performance. 11 Refs.

Primary Keywords: Laser-triggered Spark Gap; KRF Laser; SF₆/SF₆/Gap; DC Charging; 80 kV Operating Voltage; 7 mJ Laser Pulse

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8947
(POWER CONDITIONING; POWER CONDITIONING)

(Pulse Transformers, Materials; Saturable Reactors, Materials)
METALLIC GLASSES: A MAGNETIC ALTERNATIVE

D. Reskin (1) and L.A. Davis (2)
(1) Allied Corp., Parsippany, NJ
(2) Allied Corp., Morristown, NJ

IEEE Spectrum, Vol. 18, No. 11, pp 28-33 (11/1981).

The state-of-the-art in manufacture and application of metallic glasses is the subject of this paper. Recent improvements in manufacturing techniques are discussed qualitatively with predictions on future growth presented. Some of the properties of metallic glasses are shown. Present and future applications are noted. 14 Refs.

Primary Keywords: Metallic Glass; Properties; Manufacturing Technology; Applications

COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION

8951
(ENERGY CONVERSION, THERMAL)

(Magnetohydrodynamics)
Numerical Study of Unsteady Processes in a Faraday MHD Generator
G.N. Vinogradov and V.P. Panchenko
I.V. Kurchatov Institute of Atomic Energy, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 127-133 (02/1981).
Trans. From: *Teplofizika Vysokikh Temperatur* 19, 164-171
(January-February 1981).

Unsteady processes in a Faraday MHD generator with high power-conversion coefficient are numerically studied. The establishment of steady operating modes of an MHD generator with continuous electrodes is studied when an ohmic load is connected, disconnected, or reduced. A central difference predictor-corrector scheme is used to numerically solve the partial differential equations. 10 Refs.

Primary Keywords: MHD Generator; High Power-conversion Coefficient; Unsteady Process; Continuous Electrodes; Theory; Numerical Calculation

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

8952
(BREAKDOWN STUDIES)

(Vacuum, Electrical)
ON THE INITIATION OF ELECTRICAL BREAKDOWN OF A HIGH VACUUM GAP
N.B. Posanov and V.L. Granovskii
Soviet Physics-Technical Physics, Vol. 1, No. 3, pp 471-478 (02/1957).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 26, (1956)

Measurements of the static and pulsed breakdown voltages of vacuum gaps between conductors made of various metals (Al, Cu, Fe, Ni, Mo, W) and of graphite, have shown that the breakdown voltage of the gap U/sub gap/ increases with an increase in the mechanical strength of the material of the anode. There is no causal connection between the onset of breakdown and the intensity of the x-radiation from the anode in the prebreakdown stage, contrary to the hypothesis put forward in this connection. 16 Refs.

Primary Keywords: Vacuum Breakdown; Static Breakdown Voltage; Pulsed Breakdown Voltage; Several Electrode Materials; Anode X-ray Irradiation

COPYRIGHT: 1957 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8954
(BREAKDOWN STUDIES)

(Gas, Electrical)
PAUSE IN PLASMA EMISSION AFTER NANOSECOND-PULSE EXCITATION
R.Kh. Amirov, E.I. Asinovskii and V.V. Markovets
Academy of Sciences of the USSR, Moscow, USSR
High Temperature, Vol. 19, No. 1, pp 37-46 (02/1981).
Trans. From: *Teplofizika Vysokikh Temperatur* 19, 47-51
(January-February 1981)

A study has been made of the characteristics of a glow discharge after perturbation by nanosecond pulse. There is a pause in the plasma emission lasting some tens of microseconds. A model is proposed that explains the results in terms of an excess electron concentration, which reduces the electron temperature and thus reduces the emission intensity. 16 Refs.

Primary Keywords: Glow Discharge; Nanosecond Pulse Perturbation; Plasma Emission Pause; Modeling; Electron Temperature Reduction

COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

8956
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, OPENING)

(Gas, Electrical; Gas, Recovery; Mechanical)
PRESSURE TRANSIENTS IN A MODEL GAS-BLAST CIRCUIT BREAKER OPERATING AT EXTRA HIGH CURRENT LEVELS

J.L. Leclerc, M.R. Smith and G.R. Jones
University of Liverpool, Liverpool, UK
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 376-384
(12/1980).

Test results for model circuit breakers operating at high current levels and with large diameter nozzles show evidence of pronounced pressure transients although the circuit breaker nozzle is not severely blocked. The magnitude and duration of these transients are sufficient to affect the arc properties and hence influence arc control during the peak current phase and to influence arc extinction at current zero. However, despite their inherent importance there exists only limited information concerning such pressure variations. The purpose of this contribution is to identify the nature and sources of the transients, to establish typical thresholds for the onset of the transients, and to determine the influence of different operating conditions upon the transients. Measurements of pressure and thermal mantle variations are used in conjunction with the electrical test model of the aerodynamic test facility to show that the measured transients arise not only from arc generation flow impedance effects but also aerodynamic resonances. The resonant pressure transients are shown to be pronounced during the peak current phase even below the thermal blocking threshold. Above the threshold, excitation of negative resistance resonance following current peak produces decreased pressures during the current-zero period which may lead to deterioration in circuit breaker performance. Higher frequency resonances also occur and become more pronounced with electrode wear. 10 Refs.

Primary Keywords: Gas Blast Circuit Breaker; Model Breaker; Pressure Transient; 100 kA Current; Modeling

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8957
(BREAKDOWN STUDIES)

(Vacuum, Electrical)
PROPERTIES OF ANCHORED CATHODE SPOTS OF A DC MERCURY VACUUM ARC
G. Eckhardt
Hughes Research Labs., Malibu, CA 90265
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 295-301
(12/1980).

Ensembles of anchored cathode spots of a DC mercury vacuum arc have been studied by fast framing and streak photography. From these photographs, several statistical properties of the cathode spots have been determined: distribution functions for their diameters, velocities, and displacements, as well as spot shape and average values for the spot current and its density. The measurements showed that the anchored cathode spots were quasi-stationary. No indications of a microstructure within the individual cathode spots were found in optical resolution of 0.37 micron. Strong evidence is presented that the DC cathode spot parameter values reported here are typical for a clean mercury surface, and that those reported in the earlier literature are typical for impurity-covered surfaces. 18 Refs.

Primary Keywords: Vacuum Breakdown; Mercury Arc; Cathode Spot; Spot Diameter; Spot Velocity; Spot Current; Quasi-stationary Spot; No Microstructure; Photographic Diagnostic

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8959
(BREAKDOWN STUDIES)

(Vacuum, Electrical)
QUALITATIVE MODEL OF INITIATION OF A VACUUM ARC I. BREAKDOWN MECHANISM
G.M. Fursei and P.H. Vorontsov-Vel'yaminov
A.A. Zhdanov Leningrad State University, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 12, No. 10, pp 1370-1376
(06/1968).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 37, 1870-1879 (October 1967)

The effect of microinhomogeneities on the development of breakdown in a vacuum gap is examined. It is shown that the field intensification in the presence of practically realizable microinhomogeneities can attain values >100. A mechanism of vacuum breakdown based on the explosive destruction of a cathode microinhomogeneity as the primary act of initiation is proposed. 55 Refs.

Primary Keywords: Vacuum Breakdown; Microprojections; Field Intensification; Microprojection Explosion; Breakdown Initiation

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8961

(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES; OPENING)
 (Gas, Electrical; Gas, Recovery; Mechanical)
 QUENCHING PROCESSES OF AXIALLY INHOMOGENEOUS ARCS IN SF₆/CIRCUIT
 BREAKERS
 E.V. Bonin, G. Bruggemann and H.G. Thiel
 High Voltage Institute, Kassel, FRG
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 344-351
 (12/1980).

The description of the arc in a modern high-voltage SF₆/circuit breaker by only one single-arc equation is not sufficiently exact for applications, especially when using constant arc parameters. In typical nozzle configurations, arcs are generally being axial inhomogeneous. For these arcs, a theory is presented taking into account the gas-flow properties determining the axial structure. This is applied for investigating an arc consisting essentially of two different parts. It is shown, how to determine for these parts the arc parameters depending on the conductances, which are required for an appropriate mathematical description. As an example a computer simulation of the performance of the investigated circuit breaker is presented, and compared with corresponding full-scale interruption tests. Breaking capacity limit as well as the complete interaction phenomena between circuit breaker and test circuit are in agreement, proving the presented theory of an axially inhomogeneous arc. 11 Refs.

Primary Keywords: Circuit Breaker; Arc Quenching; Numerical Calculation; Experiment; Theory; Dependence On Flow Properties

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8962

(BREAKDOWN STUDIES; SWITCHES; OPENING)
 (Gas, Recovery; Mechanical)
 QUENCHING PROPERTIES OF AN APC IN A DOUBLE FLOW WITH A VORTEX
 Ch. Sturzenegger, R.T. Reinhardt and H.J. Schotzau
 Speicher and Schuh Ltd, Aarau, Switzerland
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 384-389
 (12/1980).

The effect of a vortex in a gas flow on an air-blast arc is investigated. The radial density of a vortex in the compressible flow is evaluated with a simple model. The experiments show that the width of a low pressure channel on the axis of the nozzle is comparable to the theoretical values. The measured electric field strength profile is strongly influenced by the presence of such a vortex. In addition, the thermal interrupting capability is drastically lowered by vortex superimposed on the axial gas flow. 7 Refs.

Primary Keywords: Arc Quenching; Double Flow Nozzle; E-field Measurement; Vortex; Interruption Capability Reduction

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8964

(BREAKDOWN STUDIES; SWITCHES; OPENING; BREAKDOWN STUDIES)
 (Gas, Electrical; Mechanical; Gas, Recovery)
 SCALING LAWS FOR GAS-BLAST CIRCUIT-BREAKER ARCS DURING THE HIGH CURRENT PHASE
 M.T.C. Fang (1), S. Ramakrishnan (2) and H.K. Messerie (1)
 (1) University of Sydney, NSW Australia
 (2) University of Liverpool, Liverpool, UK
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 357-362
 (12/1980).

A steady state nozzle arc model based on the boundary layer integral method is established and scaling laws are derived. For affinely related nozzles, the solution is uniquely determined by a nozzle coefficient N , which is related to the stagnation conditions, the arc current, and the dimensions of the nozzle. Tests have been performed on nozzle arcs in air using two geometrically similar nozzles at three stagnation pressures. A good agreement between theory and experiment is obtained which indicates that circuit-breaker arcs can be scaled. To avoid nozzle clogging, the nominal current density at the throat (I/A_{throat}) should not exceed the highest permissible nominal current density at the throat. For all affinely related nozzles, this upper limit of current density at the throat is proportional to $(p/\rho)^{1/2}$ divided by $z^{1/2}$ to the $1/2$ power, where p/ρ is the stagnation pressure and z is z/throat the distance of the throat from the nozzle entrance. The overall arc voltage exhibits the characteristic static behavior as indicated by Braude's composite arc model. 12 Refs.

Primary Keywords: Nozzle Arc; Steady State Arc; Arc Modeling; Gas Blast Circuit Breaker; Nozzle Coefficient; Affinely Related Nozzle; Theory

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8966

(SWITCHES; OPENING; BREAKDOWN STUDIES; BREAKDOWN STUDIES)
 (Mechanical; Gas, Electrical; Gas, Recovery)
 SIMPLIFIED ESTIMATION OF CRITICAL QUANTITIES FOR SHORT-LINE FAULT INTERRUPTION

T.E. Brown Jr.
 Westinghouse Research and Development Center, Pittsburgh PA
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 400-405
 (12/1980).

From analyses of equations derived in a previous paper for critical interrupting conditions for an arc shunted by both resistance and capacitance in parallel, or for short-line fault interruption with capacitance shunting, further analytical expressions useful for prediction of limiting conditions are derived. Examples, based on observed relations of Cassie-Mayr arc model parameters to current rate of change for a particular SF₆/blast circuit breaker, show realistic plots of limiting short-line fault currents versus line length with capacitance shunting. Also shown are required capacitance shunt values as functions of busfault current, fault fraction, line length, and number of series breaks. In the equations are circuit voltage and frequency and line surge impedance. Finally, it is shown that similar relations can be derived by using an approach suggested by A.M. Cassie in 1939. 6 Refs.

Primary Keywords: Gas Blast Circuit Breaker; Circuit Parameter Interaction; Cassie-Mayr Arc Model

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8968

(BREAKDOWN STUDIES)
 (Gas, Electrical)
 SPECTROSCOPIC APPROACH TO THE ANALYSIS OF HIGH CURRENT ARCS IN SF₆/CIRCUIT BREAKERS
 S. Okuda (1), Y. Ueda (1), Y. Murali (1), T. Miyamoto (1), Y. Doi (2)
 and C. Uematsu (2)
 (1) Mitsubishi Electric Corp., Amagasaki, Japan
 (2) Kyoto University, Yoshida, Hon-machi, Sakyo-ku, Kyoto, Japan
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 395-399
 (12/1980).

Spectroscopic observations were carried out on transient free-burning arcs drawn by separating copper/tungsten electrodes in SF₆/gas. The peak value of the arc current was varied up to 60 kA. A new optical method was developed to measure temperature and pressure profiles of the arc taking the magnetic pinch force into account. The arc voltage calculated from the obtained temperature and pressure profiles agreed well with electrical measurements. The results made it clear that the composition of the arc changes significantly at the critical instantaneous current of 10 kA. Above 10 kA the arc is composed of the electrode vapor, while it contains SF₆/gas below 10 kA. 6 Refs.

Primary Keywords: SF₆/Breakdown; 60 kA Arc Current; Spectroscopic Diagnostic; Arc Temperature Profile; Arc Pressure Profile; Calculated Arc Voltage; Comparison With Measured Voltage

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8971

(SWITCHES; CLOSING)
 (Gas, Gas, Electrical)
 SWITCHING CHARACTERISTICS OF A THREE-ELECTRODE SPARK GAP

G.A. Vorob'ev and G.S. Korshunov
 Tomsk Polytechnic Institute, Tomsk, USSR
 Soviet Physics-Technical Physics, Vol. 12, No. 9, pp 1251-1254
 (8/1968).
 Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1707-1711 (September 1967)

The switching characteristics of a three-electrode spark gap with an auxiliary 'heater' capacitance operating under atmospheric conditions are discussed. It is shown that the switching time is affected by the magnitude of the 'heater' capacitance, the overvoltage across the second spark gap, the mutual irradiation of the spark gaps in the process of discharge, and the circuit inductance. The shortest pulse rise time is 5 nsec. 5 Refs.

Primary Keywords: Three-electrode Spark Gap; Heater Capacitor; 15 kV Time; Operating Voltage; 200 A Current; Nanosecond Rise Time

COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8972

(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION)
 (Gas, Electrical; Miscellaneous)

TEMPERATURE DIAGNOSTICS IN TURBULENT ARCS

Y.K. Chien and D.M. Benenson
 State University of New York at Buffalo, Buffalo, NY 14226
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 411-417
 (12/1980).

Time averaged radial distribution of temperature and its fluctuations have been obtained for turbulent (and laminar) DC-argon arcs operated at 65 A in a 1-cm diam channel. With laminar arcs fluctuations proceeded inward from the outer edge and the percent case temperature fluctuations were about 1 percent and 4 percent at the center-line and outer edge, respectively. Relatively large fluctuations in temperature, about 5 percent, were found across the entire column where the arc was turbulent. Counterline temperatures were nearly identical for both laminar and turbulent arcs-about 1861 Deg K. This analytical development is an extension of the model of Schreiber and Hunter. 24 Refs.

Primary Keywords: Turbulent Arc; Temperature Diagnostics; DC Arc; Argon Gas; 65 A Current; 5 Percent Temperature Variation

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8974

(BREAKDOWN STUDIES)
 (Gas, Electrical)

THE EFFECTS OF COLD GAS INJECTION ON A CONFINED ARC COLUMN

D.M. Chen, K.C. Hsu, C.H. Liu and E. Pfender
 University of Minnesota, Minneapolis, MN
 IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 425-430
 (12/1980).

This paper considers the interaction of a thermal argon arc plasma confined in a relatively long water-cooled cylindrical tube with a cold argon flow injected radially into the tube through a circumferential slit. An analytical model is established to predict the thermal, the fluiddynamic, as well as the electrical behavior, of such an arc assuming laminar flow and Local Thermodynamic Equilibrium (LTE) of the arc plasma. Numerical solutions for the field variables are obtained by solving simultaneously the mass, momentum, energy, and charge conservation equations by an iterative finite difference method. The results show that the arc column becomes constricted at the location of gas injection due to thermal and fluiddynamic effects associated with the injected cold flow. The arc responds to the constriction by an increase of the temperature in the core region which resists the penetration of the cold flow into the arc. This penetration remains relatively small even at high injection ratios because the arc temperature is high, therefore, the gas tends to flow penetration increases with increasing injection ratio. The enhanced Joule heating in the injection region leads to a minor thermal expansion of the base flow which can be observed upstream of the injection slit. This effect becomes less pronounced as the injection mass flow rate increases. 12 Refs.

Primary Keywords: Confined Arc; Argon Arc; Cold Argon Injection; Theory; Analytical Model; Numerical Calculation

COPYRIGHT: 1980 IEEE, REPRINTED WITH PERMISSION

8977

(SWITCHES; OPENING)
(Explosive Fuses)THE VOLTAGE ACROSS A FUSE DURING THE CURRENT INTERRUPTION PROCESS
L. Vermij
HOLOE N.V., Utrecht, Netherlands
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 460-468
(12/1980).

Results of experiments with fusing wires are discussed and explained theoretically. Multiple arcing is observed; it is explained in a thermodynamic model. Also, the possible absence of multiple arcing at high currents is explained. There, evaporation of superheated fuse material causes the fast increase of the fuse resistance. This evaporation explains the experimentally observed behavior of the fuse resistance as a function of fuse diameter, whereas the concept of multiple arcing fails to do so. Results from experiments confirm energy balance equations, both for fuses in air and for fuses embedded in fine-grained sand. The energy balance equation for the latter case is shown to be equivalent to Moir's equation. 20 Refs.

Primary Keywords: Fuse; Multiple Arcing; Fuse Resistance; Theory; Energy Balance Equation; Moir's Equation

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8978

(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES; OPENING)
(Gas; Electrical; Gas; Recovery; Mechanical)THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE STOCHASTIC BEHAVIOR OF AN SF₆/SUB 67/ BLAST-SWITCHING ARC
K. Moller, R. Schmidt and B. Sporckmann
High Voltage Lab., Aachen, FRG
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 352-356
(12/1980).

This paper deals with some fundamental guidelines for the establishment of a stochastic arc model. Its aim is to describe the well known statistical behavior of the interrupting limit of circuit breakers taking into account short time fluctuations of the arc properties. This stochastic arc model is based on a phenomenological arc description regarding the switching arc as an electric two-pole. The arc parameters are no longer understood as deterministic functions but as stochastic processes. Their probability density distributions and the respective autocovariance and crosscovariance functions are the mathematical means to establish the model. Pseudorandom generators are used to compute switching processes of an electrical network connected to a stochastic arc. Experiments of an SF₆/SUB 67/ model circuit breaker were carried out with respect to the statistical behavior of its current, arc voltage, conductivity, and interrupting limit. From these experiments the necessary arc parameters were taken in an iterative strategy. With these parameters it was possible to reach good agreement between measured and calculated values of the failure probability of the breaker under test. 8 Refs.

Primary Keywords: SF₆/SUB 67/ Breakdown; Gas Blast Circuit Breaker; Arc Modeling; Breaker Opening Limit; Statistical Analysis; Experiment; Theory

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8979

(BREAKDOWN STUDIES)
(Gas; Electrical)THEORETICAL MODEL FOR BREAKDOWN OF FLASH-DISCHARGE TUBES CAUSED BY INTERNAL PRESSURE DURING VAPORIZATION OF WALL MATERIAL
V. V. Ivanov, A. I. Kobzarev, V. A. Prokopchenko and A. G. Rozanov
Moscow, USSRHigh Temperature, Vol. 19, No. 1, pp 137-141 (02/1981).
Trans. From: Teplotifizika Vysokikh Temperatur 19, 177-181
(January-February 1981)

A theoretical model is proposed for breakdown of flash-discharge tubes caused by internal pressure during vaporization of the wall material. An analytic expression is obtained for the limiting energy of a flash discharge tube by solving the heat-conduction equations successively for the heating stage and wall vaporization stage. It is shown that the theoretical calculations and experimental data are in satisfactory quantitative agreement. 18 Refs.

Primary Keywords: Gas Breakdown; Thermal Conduction; Wall Vaporization; Pressure Increase; Theory; Comparison with Experiment

Secondary Keywords: Flash Tube

COPYRIGHT: 1981 PLenum Press. REPRINTED WITH PERMISSION

8980

(BREAKDOWN STUDIES)
(Gas; Electrical)THEORY OF POWERFUL NONSTEADY XENON DISCHARGE TAKING VAPORIZATION OF ITS STABILIZING WALLS INTO ACCOUNT
V. M. Gladov, V. V. Ivanov, Yu. I. Keren'ev and A. A. Shcherbakov
High Temperature, Vol. 19, No. 1, pp 22-25 (02/1981).
Trans. From: Teplotifizika Vysokikh Temperatur 19, 28-35
(January-February 1981)

A complex mathematical model of a nonsteady xenon discharge of average duration of 100-100 microseconds is developed, taking effects on the quartz walls into account. The processes in the pulse lamp in conditions of shell vaporization are investigated theoretically and experimentally. 23 Refs.

Primary Keywords: Xenon Discharge; Pulsed Discharge; Wall Stabilization; Quartz Wall; Modeling; Experiment; Theory

Secondary Keywords: Flashlamp Operation

COPYRIGHT: 1981 PLenum Press. REPRINTED WITH PERMISSION

8981

(BREAKDOWN STUDIES)
(Gas; Recovery)

THERMAL LAYERS IN POSTARC CHANNEL

Z. Kalinowski
Technical University of Lodz, Lodz, Poland
IEEE Transactions On Plasma Science, Vol. PS-8, No. 4, pp 449-454
(12/1980).

The subject of the investigation is a short arc burning in air between electrodes made of refractory materials. Based on measurements of the electrical conductivity of near-electrode regions, as well as on calculations, it is stated that thermal reignition takes place in a thermal layer near the new anode. In the paper, a model of short arc thermal reignition is presented and the results of calculations are compared with measurements. These results shed light on postarc conditions in low voltage circuit breakers. 7 Refs.

Primary Keywords: Postarc Channel; Temperature Measurement; Electrical Conductivity Measurement; Arc Reignition; Thermal Reignition

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8982

(BREAKDOWN STUDIES; SWITCHES; CLOSING)
(Vacuum; Electrical; Vacuum Gaps; Electrical)TIME DELAY IN TRIGGERED VACUUM GAP
A. W. Hull
General Electric Co., Schenectady, NY 12301
IEEE Transactions On Electron Devices, Vol. ED-13, No. 6, pp 529-530
(06/1966).

A proposed theory of metal vapor arcs in vacuum, based on the assumption of field emission of electrons, has been used to calculate the time delay of Lafferty's Triggered Vacuum Gap, with excellent agreement with experiment. 7 Refs.

Primary Keywords: Vacuum Breakdown; Field Emission; Vacuum Spark Gap; Delay Measurement; Theory

COPYRIGHT: 1966 IEEE. REPRINTED WITH PERMISSION

8984

(BREAKDOWN STUDIES)

(Vacuum; Electrical)

A CATHODE SPOT MODEL AND ITS ENERGY BALANCE FOR METAL VAPOUR ARCS
J. E. Daalder
Eindhoven University of Technology, Eindhoven, Netherlands
Journal Of Physics D: Applied Physics, Vol. 11, No. 12, pp 1667-1682
(06/1978).

A non-stationary cathode spot model is proposed which is based on an interpretation of experimental data recently obtained. The significant difference made by this model is that the separation of energy flows associated with electron and ion currents in the cathode spot are the main differences with other known cathode spot models. The ion energy balance at the metal-vacuum transition is evaluated quantitatively and applied to a calculation of the ion fraction in the cathode current. For a broad range of metals and independent of the electron emission mechanism, minimum and maximum ion current fractions are found of around 10% and 20% respectively. By considering TF emission it is shown that the ion currents oriented from and towards the cathode have the same size, each being 10% of the arc current or somewhat higher. The dominant influence of the electric field on the electron emission is established. This result is in agreement with the total ion mass produced by Joule heating in the cathode as has been previously calculated for the same range of metals. 49 Refs.

Primary Keywords: Vacuum Breakdown; Cathode Spot; Joule Heating; Ion Generation; Electron Current; Ion Current; Modeling; Field Emission

COPYRIGHT: 1978 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8985

(BREAKDOWN STUDIES)

(Vacuum; Electrical)

COMPONENTS OF CATHODE EROSION IN VACUUM ARCS
J. E. Daalder
Eindhoven University of Technology, Eindhoven, Netherlands
Journal Of Physics D: Applied Physics, Vol. 9, No. 16, pp 2379-2384
(11/1976).

The composition of cathode mass loss was analysed for cadmium, copper and molybdenum vacuum arcs. It showed that two dominant flows are present, one consisting of ions, the other of molten droplets which have sizes in the order of microns to tens of microns. The droplet flow is mainly oriented along the cathode plane and is strongly dependent on the temperature of the cathode metal and the charge transfer by the arc. The cathode mass loss in vapour form is considered to be small. 26 Refs.

Primary Keywords: Electrode Erosion; Cathode Erosion; Cadmium Cathode; Copper Cathode; Molybdenum Cathode; Mass Loss; Measurement; Ion Migration; Metal Droplet Flow; Charge Transfer Dependence

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

8987

(DIAGNOSTICS AND INSTRUMENTATION)

(Systems)

DIGITAL IMPULSE RECORDER FOR HIGH-VOLTAGE LABORATORIES

P. Malewski and A. Dechampain
Hydro-Quebec Institute of Research, Varennes, Quebec, Canada
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-99, No. 2, pp 636-649 (04/1980).

A digital recorder has been developed for use in HV laboratories as a prospective replacement for conventional impulse oscilloscopes. The new apparatus has a sufficiently high time resolution to record the fastest microsecond impulses used for HV testing and also allows slower switching transients to be monitored. In order to immunize the sensitive electronic circuits of the recorder against the high electromagnetic interference of HV test areas, the authors conducted an experimental study of the nature of this interference and its magnitude and used the results to calculate the shielding and supply line conditioning systems. The recorder is designed as a mobile unit composed of an input attenuator compatible with the impulse voltage dividers, an analog-to-digital converter, an interface and a graphic computer terminal. The recorded impulses are displayed with the calibrated voltage and time axes on the terminal screen and can be printed or stored on magnetic tape for further processing. The paper points out new problems ensuing from the application of digital recorders to the HV impulse testing technique. 12 Refs.

Primary Keywords: Digital Impulse Recorder; 100 ns Resolution; Stand Alone System; Noise Sensitivity Analysis

COPYRIGHT: 1980 IEEE. REPRINTED WITH PERMISSION

8988

(SWITCHES; CLOSING)

(Gas Gaps; Crossed-field)

FEASIBILITY OF A HIGH AVERAGE POWER CROSSED FIELD CLOSING SWITCH
M. A. Lutz, R. J. Harvey and H. Alting-van Geurten
Hughes Research Lab., Malibu, CA 90265
IEEE Transactions On Plasma Science, Vol. PS-4, No. 2, pp 118-128
(06/1976).

Results of an experimental program to determine the feasibility of using a crossed field device as a high average power triggered closing switch are presented. The gap contained coaxial cylindrical electrodes and was triggered by pulsed magnetic fields (B_0, T_0) to a value sufficiently high to trap electrons and initiate conduction. Hold-off voltages up to 60 kV were achieved with peak (dc circuit) limited currents as high as 20 kA and pulse durations in the range of 1 to 100 microseconds. Ignition jitter was approximately 0.1 microsecond, and the voltage recovery rate was 2 kV/microsecond after 20 kA conduction and a 50 microsecond deionization time. These single and double shot data indicate that it should be possible to build such a device to operate at high average power levels for use in high power (kW) modulators. 9 Refs.

Primary Keywords: Crossed Field Closing Switch; Coaxial Switch; Magnetic Trigger; 60 kV Operating Voltage; 20 kA Current; 100 ns Jitter; High Average Power

COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

8990
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS; POWER CONDITIONING)
(Magnetic; Capacitive Banks; Pulse Forming Lines)
PRODUCTION OF PULSED MAGNETIC FIELDS WITH A FLAT PULSE TOP OF 440 KOE
AND 1 SEC DURATION

G. Dworschak, F. Haberey, P. Hildebrand, E. Kneller and D. Schreiber
Institut für Werkstoffe der Elektrotechnik, Ruhr-Universität Bochum, FRG
The Review Of Scientific Instruments, Vol. 45, No. 2, pp 243-249
(02/1974).

A capacitance discharge unit for the production of pulsed magnetic fields up to 440 kOe is described. The pulse formed by a passive network has a field plateau of approximately 1 msec duration for a half-period of approximately 3.5 msec and a field ripple of delta H/H < 1%. The unit occupies approximately 10 sq m., the total weight is 600 kg. It can be produced at low cost. 22 Refs.

Primary Keywords: Magnetic Field Generation; Air Core Coil; Mechanical Analysis; Pulse Forming Network; 2.5 KV Output Voltage; 1 ms Pulse Width; Rectangular Pulse; Thyristor

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8991
(BREAKDOWN STUDIES)

(Gas; Electrical)

INTEGRAL METHODS OF ANALYSING ELECTRIC ARCS. I. FORMULATION

M.D. Cowley
University of Cambridge, Cambridge, CB21PZ
Journal Of Physics D: Applied Physics, Vol. 7, No. 16, pp 2218-2231
(11/1974).

The equations of continuity, momentum and energy are derived for axisymmetric electric arcs in terms of general radial integrals. The external flow is assumed to be adiabatic, reversible and one-dimensional, although compressibility and the possibility of time variation are included. The overall integrals define quantities with the dimensions of areas when their integrands are normalized. Arc problems can then be solved in principle if relations between the area quantities can be guessed or found empirically, and a formal structure for such empiricism is suggested. It is shown that the enthalpy-flow model of Frost and Liebermann is equivalent to an integral method at a low level of approximation. The analyses of Topham are related to the present general information. 12 Refs.

Primary Keywords: Gas Breakdown; Axis Gas Flow; Theory; Magnetohydrodynamic Analysis; Theory; Empirical Area Relations

COPYRIGHT: 1974 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8992
(BREAKDOWN STUDIES)

(Gas; Electrical)

INVESTIGATIONS OF GLOW DISCHARGE FORMATION WITH VOLUME PREIONIZATION
L.F. Kline and L.J. Denes
Westinghouse Research and Development Center, Pittsburgh PA
Journal Of Applied Physics, Vol. 46, No. 4, 1567-1574 (04/1975).

The discharge formation process has been studied experimentally for CD/sub 2/ planar TEA laser discharges. Theoretical models are presented which predict the preionization electron and ion densities, the spatiotemporal development of the discharge plasma, discharge voltage, and current waveform, and the quasi-steady operating characteristics of the discharge. The results are provided in the experiments by a pulse of ultraviolet radiation. The glow discharge formation model accounts for cathode photoemission and anode collection of electrons, discharge-circuit interactions, and gaseous ionization processes. The model predicts that photoemission and anode collection can be neglected when strong preionization and moderate overvoltages are used. When photoemission and anode collection are neglected, the discharge formative time is independent of the discharge volume. Calculated and experimental voltage and current waveforms are in very good agreement. The results of the calculations show that the discharge formative time is determined primarily by the characteristics of the external circuit in the experiments. Formation calculations for a large-volume discharge show that a uniform glow discharge will develop even when the preionization is nonuniform along the electric field, and confirm that the formative time is approximately independent of the discharge volume. 38 Refs.

Primary Keywords: Glow Discharge; Ultraviolet Preionization; Volume Preionization; Theory; Plasma Development; Discharge Voltage; Discharge Current; Comparison With Experiment

Secondary Keywords: Gas Laser Pumping

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8993
(DIAGNOSTICS AND INSTRUMENTATION)

(Current)

ON THE HIGH-FREQUENCY RESPONSE OF A ROGOWSKI COIL

J. Cooper
Imperial College Of Science And Technology, London, UK
Plasma Physics (Journal Of Nuclear Energy Part C), Vol. 5, No. 5, pp 285-289 (01/1963).

In this paper a Rogowski coil with a capacitive shield is treated as a distributed circuit, so that the toroidally wound coil acts as a delay line. It is shown that, in general, the high-frequency response is limited by the transit time around this delay line, and for times greater than this transit time the individual circuit elements act as lumped impedances. However, if the flow of the current to be measured is such that it is symmetrical with respect to the toroidal coil (so that the voltage induced per unit length along the coil, when the current changes, is constant), the transient response becomes less than the transit time for a termination whose impedance is small compared with that of the toroidal coil. The best results may be obtained with an inductive termination whose impedance has the same phase angle as the impedance of the toroidal coil, and for this termination the output is proportional to the rate of change of current. 6 Refs.

Primary Keywords: Rogowski Coil; Capacitive Shield; Modeling; Delay Line; No Transit Time Limitation

COPYRIGHT: 1963 PERGAMON PRESS, REPRINTED WITH PERMISSION

8994
(BREAKDOWN STUDIES)

(Exploding Wires)

OPTIMIZATION OF ENERGY CONVERSION IN ELECTRICAL EXPLOSION OF A CONDUCTOR IN A LIQUID

V.K. Rakhusa and N.M. Stolichnaya
Institute Of Heat And Mass Transfer, Academy Of Sciences Of The

Belorussian SSR, Minsk, USSR

Soviet Physics-Technical Physics, Vol. 18, No. 6, pp 775-778 (12/1973).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1222-1237 (June 1973).

Optimum relations between the dimensions of the exploding conductor and the parameters of the discharge circuit are found from the condition maximizing the efficiency for the conversion of electrical energy stored in a capacitor into the mechanical energy of the deformation of cylindrical thin-walled transducers. Comparison shows a good agreement between theory and experiment. 15 Refs.

Primary Keywords: Exploding Wire; Liquid Environment; Wire Dimensions; Discharge Circuit Parameters; Optimization; Experiment; Theory; Good Agreement

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

8995

(BREAKDOWN STUDIES)

(Gas; Diagnostics)

PHOTOELECTRIC SPECTROSCOPY OF TRANSIENT DISCHARGES

Tsui-Peng, C.M. Cundell and J.D. Craggs
University of Liverpool, Liverpool, UK

Spectrochimica Acta, Vol. 19, pp 452-459 (01/1953).

Details are given of various optical techniques used with photomultiplier tubes in the measurement of the relative intensities of spectral lines in the emission spectra of transient discharges, notably sparks lasting a few microseconds. 20 Refs.

Primary Keywords: Gas Discharge; Spectroscopy; Optical Techniques; Experiment; Current Discharge; Calibration Techniques

COPYRIGHT: 1953 PERGAMON PRESS, REPRINTED WITH PERMISSION

8996

(PARTICLE BEAMS, ELECTRON)

(Generation)

KAL'MAR-1 PULSED ELECTRON ACCELERATOR WITH RELATIVISTIC ELECTRON BEAM

POWER OF UP TO SE12 W/SQ.CM.

B.A. Demidov, M.V. Ivkin, V.A. Petrov and S.D. Fenchenko
Soviet Atomic Energy, Vol. 46, No. 2, pp 111-116 (02/1979).

Trans. From: Atomnaya Energiya 46, 100-104 (February 1979).

The possibility of achieving controlled thermonuclear fusion by using relativistic electron beams (REB), first pointed out by Zvezdikin, is arousing ever-increasing interest. As shown by Rudakov, REB with a current of the order of 1E7 A and a power density of the order of 1E13 W/sq.cm. are required to accomplish this. The present paper describes the Kal'mar-1 accelerator producing REB with a power density of SE11 - SE12 W/sq.cm. We give the results of investigations on REB focusing in a high-voltage diode as a function of the electrode geometry and the magnitude of the voltage prepulse. 14 Refs.

Primary Keywords: Kal'mar-1 Accelerators; Field Emission Diode; 1 MeV Electrons; 10 MA Current; 1.5 Ohm Diode Impedance; Trigatron

COPYRIGHT: 1979 PLenum Press, REPRINTED WITH PERMISSION

8997

(BREAKDOWN STUDIES)

(Gas; Corona)

PULSES IN NEGATIVE POINT-TO-PLANE CORONA

L.B. Loob, A.F. Kip and G.G. Hudson
University of California, Berkeley CA

Physical Review, Vol. 60, pp 714-722 (11/1941).

The failure of W.H. Bennett working with very fine negative points and of G.G. Hudson working with larger carefully polished negative Pt points in clean dry dust-free air to observe the regular relaxation oscillator-like pulses reported by Trichel for negative points in room air led to a further study of the Trichel pulses. It was found by Kip and Bennett independently that the onset potentials and the current voltage characteristics of the corona showing Trichel pulses are independent of the size of the point and that the width of the point is, in turn, independent of the onset potential. Bennett and Hudson found that the regular Trichel pulses originate as they do in the gas require the presence of a source of triggering electrons. These can be furnished from fine points or by roughness on larger points through field emission, by very fine dust specks. Thus room air, yielding negative ions and providing ample numbers of fine dust specks for triggering, yields the regular Trichel pulses while clean, dry dust-free air, giving but rare dust specks, yields random bursts of pulses of irregular form. The theory of the phenomenon is reconsidered in the light of the findings and it is shown that the theory proposed by Trichel is applicable except as modified by the influence of the negative ion space charge and the necessity of triggering electrons. 13 Refs.

Primary Keywords: Corona; Point-plane Gap; Air Gap; Corona Pulses; Trichel Pulses; Effect Of Particles; Field Emission

COPYRIGHT: 1941 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION

8998

(BREAKDOWN STUDIES)

(Liquid, Electrical)

SOME FEATURES IN THE ELECTRIC BREAKDOWN OF ELECTROLYTES

N.P. Mel'nikov, G.A. Ostrovskiy and A.A. Shteinberg

A.A. Zhdanov Lenningrad State University, Lenningrad, USSR

Soviet Physics-Doklady, Vol. 7, No. 12, pp 1102-1104 (06/1963).

Trans. From: Doklady Akademii Nauk SSSR 147, 822-825 (December 1962).

The characteristics of a capacitor discharge in an aqueous electrolyte are studied. A capacitor is connected across a test cell by use of a trigatron gap to produce a step voltage of 15 KV across a gap of 1.75-20 mm. Several electrolytes are tested over a wide range of concentrations. Three distinct regions of concentration are found: 1) breakdown possible; 2) breakdown with aperiodic discharge of capacitor; and 3) no breakdown with oscillatory discharge. 13 Refs.

Primary Keywords: Liquid Breakdown; Electrolytes; Three Regions Of Concentration; Several Electrolytes; Wide Range Of Concentration; Variable Gap Spacing

COPYRIGHT: 1963 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

220

- 8999**
(BREAKDOWN STUDIES)
(Liquid; Electrical)
THE BREAKDOWN OF AN ELECTRIC DISCHARGE IN AQUEOUS ELECTROLYTES
N.P. Dol'nikov, G.A. Ostrovskii, and N.V. Stoyak
Soviet Physics Doklady , Vol. 8, No. 2, pp 176-178 (08/1963).
Trans. From: Doklady Akademii Nauk SSSR 148, 1057-1059 (February 1963)
 Several empirical formulas are given for the breakdown of aqueous electrolytes in this paper. NaCl dissolved in water is classified into three distinct concentration (conductivity) level ranges and the breakdown properties are found to be consistent within each classification. Pulsed voltages of up to 16 kV are used to produce breakdown. 2 Refs.
Primary Keywords: Electrolyte Breakdown; Salt Electrolyte; Glow Discharge; Brush Discharge; Statistical Sample; Empirical Formula
COPYRIGHT: 1963 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 9000**
(BREAKDOWN STUDIES)
(Surface Flashover)
TRACKING IN POLYMERIC INSULATION
H.J. Billings, A. Smith and R. Wilkins
University of Manchester, Manchester, UK
IEEE Transactions On Electrical Insulation, Vol. EI-2, No. 3, pp 13-17 (03/1967).
 Chemical mechanisms of tracking and erosion are reviewed by considering mechanisms of conduction and molecular structure of polymers. It is shown that track formation need not necessarily be by graphite formation and that degradation mechanisms cannot always be predicted by inspection of molecular stereochemistry. 25 Refs.
Primary Keywords: Insulator Tracking; Insulator Erosion; Conduction Mechanism; Graphite Formation; Molecular Stereochemistry
COPYRIGHT: 1967 IEEE, REPRINTED WITH PERMISSION
- 9007**
(SWITCHES, CLOSING)
(Vacuum Gaps; Electrical)
RECOVERY CHARACTERISTICS OF A TRIGGERED-VACUUM GAP AT HIGH CURRENTS
J.D. Cobine and L.E. Prescott
General Electric Co., Schenectady, NY 12301
Journal Of Applied Physics, Vol. 42, No. 12, pp 4865-4869 (11/1971).
 A system has been devised for use with a high-current generator whereby the recovery-strength characteristics of a triggered-vacuum gap (TVG) may be determined. Data are presented for an experimental hydrogen-triggered TVG for currents of 2000, 5000 and 10000 A, the latter value being near the upper limit of the tube studied. The causes of data scattering are discussed. 10 Refs.
Primary Keywords: Metal Vapor; Residual Gases; Thermionic Emission; Varying Recovery Strength
COPYRIGHT: 1972 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 9012**
(SWITCHES, OPENING)
(Mechanical; Materials)
DEVELOPMENT OF CONTACT MATERIALS FOR VACUUM INTERRUPTERS
P. Barkan (1), J.M. Lafferty (2), T.H. Lee (1) and J.L. Lento (1)
⁽¹⁾ General Electric Co., Philadelphia, PA 19151
⁽²⁾ General Electric Co., Schenectady, NY 12301
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-90, No. 1, pp 350-359 (02/1971).
 Conventional contact materials cannot simultaneously meet three of the most critical functional requirements of the high capacity vacuum interrupter. This paper describes the development of a new class of vacuum interrupter contact alloys which offer exceptional properties combining high interrupting capability, high dielectric strength, and anti-welding. The mechanism by which anti-welding is achieved is described and substantiated by test results. 41 Refs.
Primary Keywords: Vacuum Interrupter; Several Contact Alloys; High Interrupting Capability; High Dielectric Strength; Anti-welding
COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION
- 9031**
(SWITCHES, CLOSING)
(Vacuum Gaps, Electrical)
INDUCTANCE AND INTERNAL RESISTANCE OF VACUUM DISK SWITCHES
G.N. Artobol', V.I. Vasil'ev, M.I. Fergen' and S.S. Tsvetkov
Soviet Physics Technical Physics, Vol. 13, No. 6, pp 818-821 (12/1968).
Trans. From: Zhurnal Tekhnicheskikh Nauk 38, 107-111 (Jan-Mar 1969).
 Previous communications have described the control and electrical strength of these switches. Here estimates are made of their inductance and internal resistance, which with the results made previously allow recommendations on the design and use. 5 Refs.
Primary Keywords: Vacuum Disk Switch; Performance Test; Diagnostics; Inductance Measurement; Resistance Measurement; Design Considerations
COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 9121**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
SPECTROSCOPIC STUDY OF THE PLASMA OF A LOW-VOLTAGE PULSE DISCHARGE IN VACUUM
V.A. Durovshchikov and M.A. Deryabin
Moscow, USSR
High Temperature, Vol. 4, No. 1, pp 16-22 (02/1966).
Trans. From: Teplotifizika Vysokikh Temperatur 4, 20-26 (January-February, 1966).
 Results of a spectroscopic study of plasma formed in a pulse discharge between solid electrodes of coaxial geometry are presented, the initial pressure in the vacuum chamber being 10^{-5} to 10^{-6} mm Hg. The excitation temperatures in various parts of the jet were determined by Dransfeld's method. The distribution of doubly-charged aluminum ions over the excited states was determined. A maximum plasma temperature was found for a certain discharge energy. The radial distribution of temperature in the anode jet was determined; the temperature rose with distance from the anode. 5 Refs.
Primary Keywords: Vacuum Breakdown; Pulse Discharge; Anode Jet; Coaxial Electrodes; Temperature; Discharge Energy
COPYRIGHT: 1966 PLenum Press, REPRINTED WITH PERMISSION
- 9126**
(BREAKDOWN STUDIES; SWITCHES, OPENING; DIAGNOSTICS AND INSTRUMENTATION)
(Exploding Wire; Exploding Fuses; Current; Voltage)
TIME RESOLVED ELECTRICAL MEASUREMENTS IN HIGH CURRENT DISCHARGES
E.C. Cassidy, S.W. Zimmerman and K.K. Neumann
National Bureau of Standards, Washington, DC 20234
The Review Of Scientific Instruments, Vol. 37, No. 2, pp 210-214 (02/1966).
 A method for measurement of the resistive component of the instantaneous voltage across a sample installed in a high voltage, high current circuit is described. Simultaneous measurement of the current permitted time resolved determination of electrical energy dissipation, power, and resistance of the sample. The system was calibrated calorimetrically, and measurements were made with exploding wire samples. 14 Refs.
Primary Keywords: Exploding Wire; Current Measurement; Voltage Measurement; Resistance Measurement; Temporal Resolution
COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 9127**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
TRANSIENT CHARACTERISTICS OF RADIATION EMISSION FROM THE PLASMA OF A PULSED DISCHARGE IN VACUUM
V.A. Derevshchikov
All-Union Institute, Moscow, USSR
High Temperature, Vol. 5, No. 3, pp 380-386 (06/1967).
 The present paper gives results of an investigation into the transient characteristics of radiation emission from the plasma of a high-current pulsed discharge between electrodes of coaxial geometry at pressures of 10^{-5} to 10^{-6} mm Hg in a vacuum chamber. Oscillograph recording of various spectral lines was carried out simultaneously with high-speed photography of the discharge by means of an SPM-2M photorecorder. The transient temperature distributions in the regions near the anode and cathode have been determined. 7 Refs.
Primary Keywords: Vacuum Breakdown; Radiation Emission; Coaxial Electrodes; Spectroscopy
COPYRIGHT: 1967 PLenum Press, REPRINTED WITH PERMISSION
- 9129**
(ELECTROMAGNETIC COMPATIBILITY)
(Lightning)
A PORTABLE SYSTEM FOR FULL-SCALE AIRCRAFT LIGHTNING-INDUCED COUPLING TESTS
H.G. Butters
McDonnell Aircraft Co., St. Louis, MO 63166
IEEE 1981 National Aerospace And Electronics Conference, pp 709 (05/1981).
 A complete test system has been developed by the McDonnell Aircraft Company, for remote site lightning testing. The system includes the modular high-voltage Marx generator, a fiber optically-coupled sensor and diagnostic system, and a computer-controlled data acquisition system. It is specifically designed to be easily packaged for shipment and readily assembled at the test site. The complete system has been used recently to perform lightning tests on the space shuttle orbiter for NASA JSC and on the USAF YF-16 aircraft for the Air Force and Navy.
Primary Keywords: Lightning Effects; Laboratory Simulation; Marx Generator; 15 MV Output Voltage; Diagnostic System
Secondary Keywords: Abstract Only
COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION
- 9139**
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines; Materials)
HIGH CURRENT AND HIGH CURRENT DENSITY PULSE TESTS OF BRUSHES AND COLLECTORS FOR HOMOPOLAR ENERGY STORES
R.A. Marshall
University of Texas at Austin, Austin, TX 78712
IEEE Transactions On Components, Hybrids, And Manufacturing Technology, Vol. CHMT-4, No. 1, pp 127-131 (03/1981).
 The incentive exists to use high collector current densities in pulsed duty homopolar generators, the current densities of interest being in the range of 15-15 MA/sq.m. Tests have been conducted in which current pulses of up to 0.25 MA with an equivalent pulselength of 0.3 s have been passed between pancake brush assemblies and flat plate collectors with collector current densities of up to 78 MA/sq.m. and current densities in the brush fingers of 570 MA/sq.m. The current carried per brush have been a comparatively low 800 A. These tests have been successful and are providing the data necessary for the design of the all-iron-rotating homopolar pulse generators. 8 Refs.
Primary Keywords: Homopolar Generator; Pancake Brush Assembly; Flat-plate Collector; 78 MA/sq.m. Brush Current Density; Performance Test
COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION
- 9141**
(PARTICLE BEAMS, ION)
(Generation)
NEW TYPE OF PULSED ION SOURCE WITH CRYOGENIC ANODE
K. Kasuya, K. Horio, T. Takehashi, A. Urai and M. Hijikawa
Tokyo Institute of Technology, Nagatsuta 4259, Midori-ku, Yokohama, Japan 227
Applied Physics Letters, Vol. 39, No. 11, pp 887-888 (12/1981).
 A magnetically insulated diode with a cryogenically refrigerated anode is proposed. The prototype of such a diode is constructed. Water ice is produced on an anode which is cooled with liquid nitrogen. A pulsed machine, consisting of a Marx generator and a Blumlein line, is used to extract ion beams from the diode. Proton beams of about 50 A and 70 keV are obtained with good reproducibility. Diode electrical characteristics and the extracted beam performance are also examined. 3 Refs.
Primary Keywords: Ion Diode; Magnetic Insulation; Water Ice Emitter; Liquid Nitrogen Cooled; 50 A Proton Current; 70 keV Beam Energy
COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9146
(INSULATION, MAGNETIC)

(*STRUCTURE OF THE FRONT OF A MAGNETIC-INSULSTION WAVE*)
A.V. Gordov
Soviet Physics Technical Physics, Vol. 23, No. 8, pp 991-992 (08/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 48, pp 1746-1748
3 Refs.

Primary Keywords: Coaxial Arrangement; Nonlinear TM Mode; Vacuum
Coaxial Waveguides; Hydrodynamic Approximation
COPYRIGHT: 1979 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH
PERMISSION

9158
(BREAKDOWN STUDIES)
(Gas, Electrical)

ELECTRON DISTRIBUTION FUNCTION IN 4:1 N/SUB 2/-O/SUB 2/ MIXTURE
M.L. Aleksandrov, F.I. Vysokalov, R.Sh. Islamov, I.V. Kochetov, A.P.
Napartovich and V.G. Pevzner
High Temperature, Vol. 19, No. 1, pp 17-21 (02/1981).
Trans. From: Teplofizika Vysoikh Temperatur 19, 22-27
(January-February 1981)

The results calculated for the electron distribution function in a
4:1 N/SUB 2/-O/SUB 2/ mixture are outlined. Tables and graphs of the
distribution function and the electronic kinetic constants are given.
25 Refs.

Primary Keywords: Air Breakdown; Electron Distribution Function;
Nitrogen-oxygen Mixture; Modeling; Ionization
Processes; No UV Radiation; Theory
COPYRIGHT: 1981 PLENUM PRESS. REPRINTED WITH PERMISSION

9200
(BREAKDOWN STUDIES)
(Gas, Electrical)

QUALITATIVE STREAMER THEORY
E.D. Lozanski and O.B. Firsov
Soviet Physics JETP, Vol. 29, No. 2, pp 367-369 (08/1969).
Trans. From: Zhurn. Ekspериментальной Teoreticheskoi Fiziki 36,
670-675 (February 1969).

A simplified calculation of streamer development is proposed,
based on the model of an ideally conducting plasma produced on the
boundaries by electron avalanches in and outside the plasma. The main
conclusions are that the streamer propagation velocity is
approximately proportional to its length and the streamer thickness
is proportional to the square root of the length; this is in good
agreement with experiment. The plasma density and the field strength
 E' in the streamer are also estimated. It is shown that E' is much
smaller than the applied field, thus confirming the assumption that
the plasma has ideal conductivity. 5 Refs.

Primary Keywords: Streamer Development Calculation; Ideally Conducting
Plasma; Estimated Field Strength; Electron Cascade;
Streamer Propagation Velocity; Plasma Density
Calculation; Field Strength Calculation; Theory
COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH
PERMISSION

9218
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE GLOW-DISCHARGE-TO-ARC TRANSITION INSTABILITY
A.J.T. Holmes
Imperial College of Science And Technology, London, UK
Journal of Physics D: Applied Physics, Vol. 8, No. 6, pp 690-695
(06/1975).

It has been observed that the cathode fall potential of an
abnormal glow discharge with a cold cathode has an upper limit, so
that if a voltage pulse exceeds this limit the discharge is converted
into a vapour arc, within less than 1E-7 s. The discharge voltage and
current densities at transition have been measured in the gas density
range 1E22-1E23 cm⁻³ in Ar, Xe, using a linear He
anode and cathode. The transition voltage is found to decrease with
rising ambient gas density and it depends only slightly on the nature
of the gas, whereas the transition current density rises linearly
with gas density and is more than one order of magnitude larger in Xe
than in He. The proposed theory of the instability, which allows for
various secondary emission mechanisms and an axial gas density
distribution in the cathode fall region, confirms the existence of a
maximum value of the cathode fall potential. A current density
perturbation changes the gas density distribution causing an increase
in total secondary electron emission and current density, and leads
to a transition to the arc. Good agreement is obtained between theory
and observations. 6 Refs.

Primary Keywords: Glow Discharge; Arc Discharge; Glow-to-arc
Transition; Cathode Fall; Xenon Gas; Mercury Vapor
Experiments; Theory
COPYRIGHT: 1975 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

9219
(BREAKDOWN STUDIES; BREAKDOWN STUDIES; SWITCHES, CLOSING)
(Vacuum, Electrical; Electrodes; Vacuum Gaps, Materials)

EXPERIMENTAL STUDY OF THE DYNAMICS OF CATHODE SPOTS DEVELOPMENT
V.I. Lebedev
All-Union Institute, Moscow, USSR
IEEE Transactions On Plasma Science, Vol. PS-4, No. 2, pp 81-102
(06/1976).

This paper presents results of a study of cathode spot size and
movement in a vacuum arc. The authors utilized an image converter
camera to photographically record 16 separate frames of vacuum arcs
for several residual gas pressures and times. Several conclusions are
drawn regarding the variation of cathode spot size and movement. An
extensive literature survey is included. 150 Refs.

Primary Keywords: Vacuum Breakdown; Cathode Spot; Spot Size; Spot
Movement; Literature Survey; Photographic
Diagnostic; Cathode Erosion
COPYRIGHT: 1976 IEEE. REPRINTED WITH PERMISSION

9233

(INSULATION, MATERIAL; BREAKDOWN STUDIES)

(*CHARGING OF INSULATOR SURFACES BY IONIZATION AND TRANSPORT IN GASES*)
C.M. Cooke
Massachusetts Institute of Technology, Cambridge, MA
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp
172-178 (04/1982).

Insulator surfaces in gases collect charge when the rate of charge
arrival exceeds the rate of conduction by the insulator from the
surface region. The source of the collected charge may be in close
proximity to, and hence greatly influenced by, the surface.
Alternatively, the source may be remote so that it releases charge
independent of the surface accumulation. For the latter arrangement,
charge transport through the gas greatly influences where it is
collected. Surface charging is desired in some situations, such as
for producing images or for producing charging is undesirable and
hazardous in other situations, for example, in electrical failure
may be triggered. A third possibility makes use of surface charge
collection as a diagnostic procedure for materials and to transport
studies. This paper is concerned with the basic production and
accumulation of surface charges from the adjacent gas and presents
results on the processes involved. Transport parameters of drift,
diffusion, and space-charge effects are considered. Examples of
charging and measured distribution under different conditions,
including saturation effects, are analyzed. 11 Refs.

Primary Keywords: Insulator Surface Charging; Charge Transport In
Gases; Charge Trajectories
COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9239

(BREAKDOWN STUDIES; INSULATION, MATERIAL; INSULATION, MATERIAL)

(*CORONA AND INSULATION*)
M. Goldman (1) and R.S. Sigmund (2)
(1) Lab de Physique des Decharges, Gif-sur-Yvette, France
(2) Norwegian Institute of Technology, Trondheim-MTH, Norway
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp
90-105 (04/1982).

The aim of this paper is to review our present knowledge of the
physics of electrical coronas and their interaction with surfaces,
with some emphasis on phenomena which seem of importance for high
voltage insulation. We will concentrate on fundamental and general
subjects. In order to limit the scope of the paper and to make it
serve as an introduction to the more specialized papers that follow.
9 Refs.

Primary Keywords: Corona Discharge; Insulator Tracks; AC Corona; DC
Corona; High-voltage Insulation; Theory
COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9257

(BREAKDOWN STUDIES; DIAGNOSTICS AND INSTRUMENTATION; INSULATION,

MATERIAL)
(*Partial Discharges; Partial Discharges; Testing*)
FUNDAMENTAL LIMITATIONS IN THE MEASUREMENT OF CORONA AND PARTIAL
DISCHARGE

S.A. Boags and G.C. Stone
Ontario Hydro Research, Toronto, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp
143-150 (04/1982).

The theoretical sensitivity of conventional partial discharge
detectors is compared with that obtained from ultra wideband (UWB)
(up to 1 GHz) detection systems. The comparison indicates that for
relatively lossfree distributed systems, such as SF₆/sub 6/ insulated
bus, the UWB system is up to two orders of magnitude more sensitive.
UWB detection also embodies additional advantages such as
facilitating the location of discharge sites and the rejection of
external electrical noise. For discharge detection in
plastic-insulated cables, true UWB detection is not practical because
of frequency-dependent attenuation effects, although certain gains in
sensitivity can be achieved with a detector bandwidth of up to 10
MHz. 21 Refs.

Primary Keywords: Partial Discharge Detector; Ultra Wideband Detector;
Comparison; Discharge Site Location; Dielectric Loss
COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9270

(DIAGNOSTICS AND INSTRUMENTATION; SWITCHES, CLOSING)

(*Current, Thyatrons*)
LOW INDUCTANCE CURRENT VIEWING RESISTORS FOR HYDROGEN THYRATRONS
C.A. Muller et al.
TEM Research Products Inc., Albuquerque, NM 87108
3rd 1981 IEEE International Pulsed Power Conference, pp 167-170
(06/1981).

Special low inductance current viewing resistors have been
designed and tested for use with low inductance thyatrons. The CVR's
add less than 3 nH measurement capability. Bandwidth of these devices
has been calculated to be DC to 300 MHz and measured to be DC to 466
MHz. Power handling and peak current capabilities of these devices
exceed that which can be switched by hydrogen thyatrons. Design
methods and a brief summary of construction techniques will be
discussed. 6 Refs.

Primary Keywords: Current Viewing Resistors; 300 MHz Bandwidth;
Hydrogen Thyatrons; Data Acquisition Systems;
Passive Integrators
COPYRIGHT: 1981 IEEE. REPRINTED WITH PERMISSION

9273

(BREAKDOWN STUDIES)

(*DC*)
MECHANISMS OF INCEPTION OF DC AND 60-HZ AC CORONA IN SF/SUB 6/
R.J. Ver Brunt and M. Misakian
National Bureau of Standards, Washington, DC 20234
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp
106-120 (04/1982).

Using a pulse counting technique, inceptions of positive and
negative point plane corona in SF₆/sub 6/ under DC and 60-Hz AC
conditions were measured. Effects of gas pressure, UV-radiation, and
point electrode size on differences between AC and DC, and between
positive and negative inceptions were investigated. Inceptions were
also calculated using the streamer criterion. Agreement was obtained
with measured negative inceptions for both AC and DC conditions, but
not with positive inceptions. The growth in the active-electron
initiation volume with applied voltage was calculated and used to
explain the observed polarity effect. The magnitude of the polarity
effect is practically reduced either by irradiating the gas or by
increasing the diameter of the point electrode. The difference
between AC and DC positive inceptions is attributed to the
enhancement of avalanche-initiating electron production by the
residual ion space charge from negative corona in the previous
half cycle. 39 Refs.

Primary Keywords: Corona Pulses; DC Corona; AC Corona; SF₆/sub 6/ Gas;
Corona Inception; Polarity Effect
COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9282
(BREAKDOWN STUDIES)
(Corona)

PARTICLE CHARGING IN DC CORONA FIELDS-A REVIEW

I.I. Inciutat
University of Western Ontario, London, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 168-171 (04/1982).

After a brief review of the currently accepted theory of particle charging in corona fields in air by both ionic bombardment and diffusion in the dark space surrounding the DC corona glow, the paper presents some of the recently published findings on particle charging within the corona glow. The study was made possible by the discovery that additions of CO₂/sub>2% to air in a 5 to 20 percent range will increase a cylindrical positive corona glow to a size which is sufficiently large to allow particles to be dropped onto various trajectories parallel to the corona wire and their charge to be measured. The influence of the shape of the particles when exposed to corona charging is also discussed. 7 Refs.

Primary Keywords: DC Corona; Heteroparticle Charging; Charge Measurement; CO₂/sub>2% Air Mixture

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9287
(BREAKDOWN STUDIES)
(Gas, Electrical)

PRE-BREAKDOWN DISCHARGES IN HIGHLY NON-UNIFORM FIELDS IN RELATION TO GAS-INSULATED SYSTEMS

H. Arai and K.D. Srivastava
University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 131-142 (04/1982).

In clean SF₆/sub>6% gas-insulated power transmission systems significant pre-breakdown discharges are rarely observed, this is so because the prevailing electric field is only moderately non-uniform. In practical systems, however, conducting particle contamination creates regions of highly non-uniform fields. Rod-to-plane gaps provide a convenient way of studying pre-breakdown discharges in SF₆/sub>6% under highly non-uniform fields under controlled laboratory conditions. The relatively few published reports of investigations of pre-breakdown discharges in SF₆/sub>6% are reviewed. Based on the authors' and other published experimental results, several pre-breakdown regimes (for example, single pulse and multiple pulse pre-discharges and incomplete breakdowns etc.) are identified. The randomness of the time delay of the first pre-discharge current pulse is attributed to the rate of production of initiatory electrons near the anode and the growth of electron avalanches thus generated. The importance of the spatial electric field distribution around the rod electrode (anode) is emphasized. 46 Refs.

Primary Keywords: SF₆/sub>6% Breakdown; Prebreakdown Phenomena; Highly Nonuniform Field; Several Prebreakdown Regimes

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9288
(BREAKDOWN STUDIES)
(Corona)

PULSE CORONA DISCHARGE IN ELECTROSTATIC PRECIPITATORS

H.I. Milde
Ion Physics Corp., Burlington, MA 01803
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 179-186 (04/1982).

In electrostatic precipitators (ESPs) the electric field is responsible for producing ions in the vicinity of the corona wires, charging particles, and transporting charged particles to the collecting plate. In standard Cottrell-type precipitators, these functions are performed by applying a DC voltage between corona electrodes and collecting plates. Because ion production requires a high electric field strength near the cathode while particle transport is optimum in a uniform field, this arrangement is always a compromise, and sometimes a poor one. Energizing precipitators with both a DC base voltage and superimposed pulse voltage, on the other hand, provides for a separation of the functions: particle transport being performed by the DC base voltage and ion production by the pulse voltage. 21 Refs.

Primary Keywords: Corona; Pulsed Corona; Wire Erosion; Voltage Decay; Particle Charging

Secondary Keywords: Electrostatic Precipitator
COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9291
(BREAKDOWN STUDIES)
(Gas, Electrical)

PULSED GLOW DISCHARGES IN LASER EXCITATION AND BREAKDOWN

L.E. Kline
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp 121-126 (04/1982).

The spatio-temporal development of discharges in uniform field gaps has been studied for many years in order to understand the physical mechanisms of breakdown. These studies have shown that a glow discharge structure is produced as an intermediate stage in the breakdown process which finally leads to the formation of a filamentary arc. Recently these pulsed or transient glow discharges have been used to pump a wide variety of gas lasers including CO₂/sub>2% lasers and rare gas-halide excimer lasers. Preionization of the gas volume is usually used to 'stabilize' these laser glow discharges, i.e. to increase the duration and/or energy density of the pulsed glow discharge and delay the onset of arc formation. Recent experimental work also has shown that the corona discharges which are observed in point-plane gaps have a glow-discharge-like structure. These two types of discharges are compared and some speculations are offered about the 'corona stabilization' process in point-plane gaps and its relationship to arc formation in uniform fluid gaps. 14 Refs.

Primary Keywords: Gas Breakdown; Pulsed Discharge; Glow Discharge; Glow to Arc Transition; Preionization; Discharge Stabilization

Secondary Keywords: Gas Laser; Pumping
COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9295
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

RESPONSE OF A TWISTED PAIR EXCITED BY THE NONUNIFORM ELECTROMAGNETIC FIELDS OF NEARBY LOOPS

J.G. Braden and H. Singh
University of Oklahoma, Norman, OK 73019
IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-24, No. 1, pp 52-58 (02/1982).

This paper derives equations for the noise induced in a twisted pair when the pair is embedded in a nonuniform electromagnetic field of a small current loop. The derived equations are applied to calculate the noise induced in a typical 135-ohm twisted pair. In the frequency range of 10 kHz-100 MHz, the noise induced in this twisted pair is shown to be less by about 70-135 dB when compared to a similar parallel-conductor line without twist that is embedded in the same field. Included is a simplified method of applying the derived equations to the problem of finding the response of the twisted pair to distinct uncorrelated noise sources, assuming that the sources can be approximated by small current loops. 10 Refs.

Primary Keywords: Twisted Pair; Transmission Line; Response To Electromagnetic Wave; Nonuniform Field; 135 dB Attenuation; Comparison To Nontwisted Pair

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9298
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

SHIELDING EFFECTIVENESS OF METALLIC HONEYCOMBS

W.A. Beereuter (1) and DC Cheng (2)
(1) Kaman Sciences Corp., Colorado Springs, CO 80907
(2) University of Colorado, Boulder, CO 80309

IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-24, No. 1, pp 58-61 (02/1982).

The shielding effectiveness (SE) of infinitely large metallic honeycombs is calculated from expressions derived by Hainstein, Mittny, and Lee for receiving and transmitting infinite parallel-plate arrays. A simple formula for the transmitted fields is presented, which is applicable for honeycomb dimensions employed in practice. 6 Refs.

Primary Keywords: Metallic Honeycomb; Shielding Effectiveness; Infinite Array; Theory; Parallel-plate Array

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9310
(BREAKDOWN STUDIES)

(Gas, Electrical)

TOPICAL PHENOMENA OBSERVED IN A SHORT-GAP ATMOSPHERIC DISCHARGE USING ROTOR AND POST ELECTRODES

M. Sugaya (1), M. Takechi (2), T. Yamashiki (3), T. Oikawa (1) and K. Fujii (1)
(1) Ibaraki University, Hitachi-shi, Ibaraki, Japan
(2) Toshiba Corp., Fuchū-shi, Tokyo, Japan
(3) Tokai Electric Mfg Co, Aichi, Japan

IEEE Transactions On Electromagnetic Compatibility, Vol. EMC-24, No. 1, pp 20-23 (02/1982).

Correlation of light emission, discharge structure, waveform of the discharge current, electrode configuration, and electromagnetic radiation is examined with the intent of obtaining an effective means for preventing electromagnetic interference (EMI) due to a short-gap discharge. The electromagnetic radiation (EMR) level resulting from a current step which, in turn, was formed by a discrete movement of a cathode spot was clearly recognized. A combination of needle rotor and needle post gave the smallest electromagnetic radiation level in the experiments. 12 Refs.

Primary Keywords: Arc Breakdown; Light Emission; Electromagnetic Radiation; Electrode Configuration; Current Waveform Correlation Of Properties; EMI Shielding

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

9350
(BREAKDOWN STUDIES)

(Vacuum, Electrical)

HIGH-CURRENT VACUUM ARCS: PART I. AN EXPERIMENTAL STUDY

G.R. Mitchell
General Electric Co, Philadelphia, PA 19153

Proceedings Of The IEE, Vol. 117, No. 12, pp 2315-2326 (12/1970).

In this paper an experimental study is presented on reburning vacuum arcs with currents up to about 100 kA peak. As the current is increased it is shown that the holding voltage continues to increase until electrode melting occurs for electrodes equal to or exceeding 10 mm in diameter. This happens during sinusoidal current loops above 10 kA peak. Once grossly melted, high-current-density spots are formed on the anode, bright constructed high-pressure columns will develop, and the mean level of the voltage may drop, even though the current is increasing. During most short arcs involving gross melting, magnetic pumping of liquid metal is given as the main force in removing metal from the electrode surface. Methods of determining anode spot temperature are discussed and estimates range from 2730 to 3350 Deg K. Part two of this article presents the theoretical interpretations of this study. 15 Refs.

Primary Keywords: Vacuum Arc; Anode Spot; Gross Electrode Melting; Spot Temperature; High-pressure Columns; 100 kA Peak Current; Power Line Frequency

COPYRIGHT: 1970 IEE

9381
(PULSE GENERATORS)

(Line Type)

TRANSIENTS IN HIGH-POWER MODULATORS

S. Schneider and G.W. Taylor
ECOM, Fort Monmouth, NJ 07703
IEEE Transactions On Electron Devices, Vol. ED-13, No. 12, pp 977-986 (12/1966).

The physical size involved in the design and construction of high-power modulators introduces high inductance and stray capacitance in the circuit. Analysis shows that under normal operation any inductance between the energy source and the RF device, together with stray capacitance, produces damped oscillations after the 'turn-on' and 'turn-off' of the RF generator beam. Unfortunately, the need for adequate protection of the RF generator and modulator required the introduction of an additional inductor in the circuit to limit the rate of rise of fault current. Improper placement of this inductor can also produce detrimental oscillations under fault conditions. Proper design can minimize these unwanted transients. An analysis of the circuit and the results obtained in a high-power modulator are discussed. 0 Refs.

Primary Keywords: Fault Transient; Transient Suppression; Effect On Normal Operation; Minimization Of Effect

COPYRIGHT: 1966 IEEE. REPRINTED WITH PERMISSION

9384
(PULSE GENERATORS)
(Trigger)

HIGH-VOLTAGE PULSE GENERATOR WITH RISE TIME <10 NSEC
V.B. Lebedev and G.A. Pryanikova
Instruments And Experimental Techniques, Vol. 21, No. 4, pp 969-970
(08/1978).
Trans. From: Priroby i Tekhnika Eksperimenta 4, 119-120 (July-August
1978).
A generator of high-voltage pulses is described, based on a controlled vacuum commutator to control an electrooptical laser shutter. 4 Refs.
Primary Keywords: Pulse Generator; 15 kV Output; 8 V Trigger; 30 pF
Storage Capacitor; Vacuum Spark Gap
COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

9386
(BREAKDOWN STUDIES)

(Gas; Electrical)
STABLE STATES OF A VOLUME DISCHARGE EXCITED BY AN ELECTRON BEAM IN AR
WITH AN SF₆/SF₆ / 6% ADMIXTURE
Yu.I. Ryshkov, Yu.D. Korolev, G.A. Mesyats, A.P. Khuzeev and I.A.
Shemyakin
Soviet Physics-Technical Physics Letters, Vol. 3, No. 11, pp 461-462
(11/1977).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 1121-1125
(November 1977).

The study of volume discharges in argon with fluorine admixtures is motivated by the effort to develop lasers that are mixtures of noble gases as active media. The experiments reported in the present letter have been carried out to determine the range of conditions corresponding to a stable volume discharge for input energies $W=0.1-1$ J/cm³. The discharge is excited by an electron beam with pulse length $\tau_{\text{av}}/b=10^{-7}$ sec and current density $j/b=3.5$ A/cm². The area of the electrodes and the exit window of the accelerator $S=5$ cm², the gap $d=1.4-2$ cm, the gas pressure $p=1$ atm, and the SF₆/SF₆ / 6% concentration is (0.025-1.2)%. 4 Refs.
Primary Keywords: Volume Discharge; Argon Gas; SF₆/SF₆ / 6% Admixture;
E-beam Excited Discharge; Effect Of SF₆/SF₆ / 6% Concentration
COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9387
(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Partial Discharges; Testing)
PARTIAL DISCHARGE EVALUATION OF POLYETHYLENE CABLE-MATERIAL BY PHASE
ANGLE AND PULSE SHAPE ANALYSIS
H.G. Kranz
University of Wuppertal, FRG
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp
151-155 (04/1982).
This paper reports on the correlation of chemical and physical degradation as a result of discharge activity and partial discharge measurements, using only real quantities. The materials investigated are LDPE and peroxide crosslinked PE. An 8-channel test arrangement, controlled by a real-time micro-computer system, has been employed for the critical evaluation. It is demonstrated that the lifetime of polymeric insulating materials depends on the type of internal partial discharges as well as on space charge and conductivity distribution. Two competing mechanisms make it difficult to evaluate discharge behavior near inception voltage: (1) Concentration of discharges to eroded surface areas causes an increase in deteriorating energy, and (2) Surface charges and electron trapping cause a decrease in the field strength. A scanning electron microscope was used to correlate electrical measurements to physical deterioration. 8 Refs.
Primary Keywords: Partial Discharge Measurement; Physical Insulation Degradation; Chemical Insulation Degradation; Polyethylene Insulation; Lifetime Prediction
COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

9388
(BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Corona; Solid)
INTERACTION OF CORONA WITH DIELECTRIC MATERIAL UNTIL DAMAGE
C. Mavoux (1), J. Sarlabous (1) and G. Garcia (2)
(1) C.N.R.S. Universite P. Sabatier, Toulouse, France
(2) Lab Central des Industries Electriques, Fontenay aux Ros es, France
IEEE Transactions On Electrical Insulation, Vol. EI-17, No. 2, pp
156-162 (04/1982).
A study of polyethylene terephthalate (PET) and polycaprolactone (PPG) treated by corona discharge for a short time is presented. Different techniques of analysis such as inverse chromatography, infrared spectroscopy, loss tangent and electric strength were used. Working at 50 Hz with a gap of 2 mm and different gases, the analysis of the polymer after treatment has shown that a transition in the transformation of the surface may be considered. Thus a critical time is defined between a pure transformation and a degradation. This latter phase is also studied with a cross linked polyethylene (XLPE). The infrared analysis and electric strength measurements have shown the role played by the relative humidity present in air. 24 Refs.
Primary Keywords: Corona; Plastic Insulation Interaction; Insulation Degradation; Several Analysis Techniques; Correlation of Physical And Electrical Degradation; Humidity Effects
COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

9390
(BREAKDOWN STUDIES)

(Lightning)
ANALYSIS OF LIGHTNING DATA FROM THE DMSP SATELLITE
B.W. Turner
Patrick AFB, Florida 32925
Journal Of Geophysical Research, Vol. 83, No. C10, pp 5019-5024
(10/1978).
A lightning detector, consisting of 12 silicon photodiodes, each with a field of view of 700 x 700 km on the earth, has been flown on a Defense Meteorological Satellite Program satellite. Peak amplitude of the lightning flash was digitized within a range of 16 discrete levels, and the largest amplitude observed within a 1-s sample interval was recorded. Approximately 10,000 lightning flashes were analyzed. The mean rate of occurrence of peak lightning power within the range 100-1000 J has been obtained. The median power level was 100 J, and about 2% of the lightning flashes had peak power greater than 1000 J. These data are compared to similar results from a ground-based experiment. Lightning flash rate per unit surface area on the earth was 56/km²/sec but this value may be biased toward high rates by the method of selecting the data base. 7 Refs.
Primary Keywords: Satellite Lightning Detection; Silicon Photodiode Array; Lightning Analysis; Flash Brightness; Lightning Electric Field Power; Large Statistical Sample
COPYRIGHT: 1978 AMERICAN GEOPHYSICAL UNION

9391
(PARTICLE BEAMS, ELECTRON)
(Generation)

EXACT SOLUTION OF POISSON'S EQUATION FOR SPACE-CHARGE-LIMITED FLOW IN A RELATIVISTIC PLANAR DIODE
J.E. Boers and D. Kellher
Sandia Labs, Albuquerque, NM 87115

Poisson's equation, governing space-charge-limited flow in a relativistic planar diode, is solved assuming the initial velocities of the accelerated particles are zero, through the use of two power series convergent in the potential range $|V|c^2/2e \leq z^2/2Z_0 + 2m_e^2/c^2$ and $2m_e^2/c^2 \ll z^2/2Z_0 \ll V$. In the region of lower potential, the solution is expressed in a power series in U , a normalized potential. As U becomes small, the solution reduces to the well-known Child's law. In the region of higher potential, a power series in inverse powers of U is employed. As U becomes large the solution reduces to the ultra-relativistic form obtained if v , the particle velocity, can be considered equal to the speed of light. Convergence of both series is rapid, and it is only necessary to retain a few terms to realize a high degree of accuracy. 4 Refs.
Primary Keywords: Poisson's Equation; Convergent Power Series; Space-charge-limited Flow; Child's Law; Theory; Numerical Calculation; Ultra-relativistic Solution

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9393
(INSULATION, MAGNETIC)

()
ONE- AND TWO-SPECIES EQUILIBRIA FOR MAGNETIC INSULATION IN CO-AXIAL GEOMETRY
K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115

The Physics Of Fluids, Vol. 20, No. 4, pp 688-697 (04/1977).

A cold-fluid, self-consistent model of electron and ion flow in coaxial cylindrical geometries is applied to the problem of magnetically insulated diodes. The one-species, nonrelativistic problem is studied to determine in what configurations and parameter domains equilibria corresponding to magnetic insulation exist. It is proved that when the outer electrode is the cathode no equilibria always exist. For the inner cathode, whether or not equilibria exist and what they are like depends on whether the field is azimuthal or longitudinal and on the ratio of the radii. The two-species relativistic problem is then analyzed with the help of a computational routine which integrates the cold-fluid differential equations and searches the parameter space for the point corresponding to space charge limited emission. As the critical field is approached from above, the resulting values of ion current show an enhancement over the single species prediction by a factor which increases with voltage and with anode radius. Patterns of nonexistence of equilibria similar to those observed for the one-species, nonrelativistic case are also found. 17 Refs.
Primary Keywords: Field Emission Diode; Magnetic Insulation; Theory; Electron Flow; Ion Flow; Cold-Fluid Model; One-species Flow; Relativistic Flow; Comparison With One-species Flow

COPYRIGHT: 1977 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9405
(DIAGNOSTICS AND INSTRUMENTATION)
(E-field)

MINIATURE ELF ELECTRIC FIELD PROBE
M. Misakian, F.R. Kotter and R.L. Kahler
National Bureau of Standards, Washington, DC 20234

The Review Of Scientific Instruments, Vol. 49, No. 7, pp 933-935 (07/1978).

A miniature AC electric field probe having direct electrical connections with its battery-operated electronics is described. Because its small size introduces little field perturbation, fields generated by relatively small electrode structures in laboratory environments can readily be characterized. 10 Refs.
Primary Keywords: E-field Probe; Small Size; Small Field Perturbation

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9408
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)

TEMPERATURE DEPENDENCE OF THE ELECTRO-OPTIC KERR COEFFICIENT OF NITROBENZENE
R.E. Hefner and M. Misakian
National Bureau of Standards, Washington, DC 20234

Journal of Applied Physics, Vol. 50, No. 9, pp 6016-6017 (09/1979).

The Kerr coefficient of nitrobenzene was measured over the temperature range 255-344 K. To within experimental error, the data indicate that the Kerr coefficient can be expressed as a quadratic function of reciprocal temperature. Fitting the data to this quadratic function yields an equation which can be used to correct the response of a pulse-voltage measuring system based on the Kerr effect for variations in the ambient temperature. 7 Refs.
Primary Keywords: Kerr Cell; Kerr Coefficient Measurement; Temperature Variation; Nitrobenzene Coefficient; Empirical Function

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9424
(PULSE GENERATORS)
(Mark)

IGNITRON-SWITCHED 0.6- TO 90-KV IMPULSE GENERATOR
E.H. Beckner and R.H. Koteksi
Sandia Labs, Albuquerque, NM 87115

The Review Of Scientific Instruments, Vol. 33, No. 9, pp 914-915 (09/1962).

An ignitron-switched impulse generator has been developed, capable of providing a variable output voltage of from 0.6 to 90 kV with no circuit alterations. The generator consists of 6 capacitor stages, yielding a total energy of 5000 J at 90 kV, and is discharged with a single trigger pulse. The discharge time can be controlled to within 0.1 microsecond. 3 Refs.
Primary Keywords: Pulse Generator; 0.6 To 90 KV Impulse Generator; 5000 J Total Energy; Single Trigger Pulse; Ignition-Switched; Low Impedance; Marx Generator

COPYRIGHT: 1962 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9429
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
CREATION OF MEGAGAUSS FIELDS BY THE METHOD OF MAGNETODYNAMIC ACCUMULATION
S.G. Al'tkhanov, V.G. Belan, G.I. Budker, A.I. Ivanchenko and G.N. Kichigina
Soviet Atomic Energy, Vol. 23, No. 6, pp. 1307-1311 (12/1967).

Trans. From: Atomnaya Energia 23, 536-541 (December 1967).
Interest in the problem of creating superstrong magnetic fields has greatly increased in recent years. Works have been published describing experiments which involve the creation of pulsed magnetic fields with high intensity and also works dealing with theoretical studies of this problem. A conference was held on megagauss fields and the possibilities of creating and using intense magnetic fields are studied in various laboratories. A method of creating a strong magnetic field has found the most widespread application. This method is based on the compression of the magnetic flux by a conducting cylindrical shell which is accelerated by external forces. The rate of compression of the shell determines the rate of flux leakage, the magnetic field strength increases. The maximum strength and the characteristic time of existence of the magnetic field are determined by the mass of the shell, the maximum attainable velocity and the trapped flux, the properties of the shell material, etc. The present work gives the results of the experiments on the creation of an intense magnetic field through flux compression by a collapsing liner. 7 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression; Explosive Driver; Electrical Driver

COPYRIGHT: 1967 PLENUM PRESS, REPRINTED WITH PERMISSION

9430
(BREAKDOWN STUDIES)

(Exploding Wires)
ELECTRICAL BREAKDOWN OF CYLINDRICAL FOILS IN AIR. III. HIGH-CURRENT EXPANDING DISCHARGE
V.A. Burtsev, A.M. Bezdomnyi, A.A. Dubovenskiy, N.P. Egorov, M.P. Kasekin, A.B. Produtov and I.V. Sivostakov
Soviet Physics-Technical Physics, Vol. 25, No. 6, pp. 697-703 (06/1980).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 50, 1216-1226 (June 1980).

Results of an experimental study are described, pertaining to electrical breakdown of cylindrical aluminum foils in air and to the expanding high-current discharge initiated by this breakdown with the geometry of an inverse longitudinal pinch. The time dependence of the plasma brightness temperature in the case of 'thin' ($1\text{--}5$ micron) foils is characterized by an initial fast-rise phase ($\tau_{\text{av}}/\text{sub ph}$ approximately 1 microsecond) and a phase of almost constant temperature throughout the entire first current half-period (τ_{av} approximately 35 microseconds). The maximum plasma brightness temperature in this case reaches $T_{\text{av}}/\text{sub ph}$ = 3.2 eV. Determination of the plasma column temperature averaged over the cross section from the electrical conductivity of the discharge, according to electrical measurements, and from high-speed photographs taken at the end of the chamber has confirmed that there is a quasi-steady discharge phase. 14 Refs.

Primary Keywords: Electrical Breakdown; Cylindrical Aluminum Foils; Expanding High-current Discharge; Plasma Column; 3.2 eV Maximum Plasma Brightness Temperature

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

9432
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
PRODUCTION OF PULSED MAGNETIC FIELDS UP TO 700 KOE

A.K. Soika and V.V. Val'yukov
Physics Institute, Academy of Sciences of the Belarusian SSR, USSR
Journal of Applied Spectroscopy, Vol. 27, No. 1, pp. 956-959 (07/1977).
Trans. From: Zhurnal Prikladnoi Spektroskopii 27, 177-181 (July 1977).

A pulsed magnetic field of high intensity is usually obtained by the discharge of a capacitor bank through a solenoid. The efficiency of this process is determined by the expression $\eta = \frac{1}{2} \frac{I^2}{C} \frac{1}{L} \frac{1}{R} \frac{1}{t^2}$, where I is the current, C is the capacity, L is the inductance, R is the resistance, t is the time of the pulse. The coefficient of effectiveness of the solenoid, equal to the ratio of the energy in the magnetic field in the useful volume to the energy of all the magnetic fields of the solenoid, η_s , is divided by η_p , where η_p is the ratio of the parasitic inductance of the discharge circuit to that of the solenoid; R is given as $R = R_0 + R_1$, where R_0 is the damping constant; the function $f(\gamma)$ is determined by a given expression. We have developed and used extensively a pulsed solenoid, the distinguishing feature of which is that the discharge, the connecting lines and the power strip are all structurally fulfilled as a whole. This allowed us to bring electric currents with opposite currents as close to each other as possible and thereby decrease the loop of the discharge curve. To achieve the largest values of the efficiencies under the given conditions, it was also important to assure a value of γ on the order of 10-20, which will then yield an insignificant decrease in η due to $f(\gamma)$. 8 Refs.

Primary Keywords: Magnetic Field Generation; Solenoid Magnetic Coils;

No Flux Compression; Analysis; High Efficiency

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

9450
(ENERGY STORAGE; MECHANICAL)

(Rotating Machines, Materials)
DESIGN OF THE LIQUID-METAL CONTACTOR IN HOMOPOLAR MACHINES

A.L. Genkin, V.A. Dievskii and Yu.P. Kos'kin
Magneto hydrodynamics, Vol. 13, No. 2, pp. 238-244 (06/1977).
Trans. From: Magnitnaya Gidrodinamika 2, 127-129 (April-June 1977).

We consider the steady flow of liquid metal in a contact device with coaxial cylindrical electrodes. This liquid-metal contactor is assumed to be in a uniform magnetic field B oriented along the z axis; the induced magnetic field has no radial and axial components. 4 Refs.

Primary Keywords: Homopolar Generator; Current Contact; Liquid Metal Brushes; Magnetic Field; Theory

COPYRIGHT: 1977 PLENUM PRESS, REPRINTED WITH PERMISSION

9451
(ENERGY STORAGE, INDUCTIVE; BREAKDOWN STUDIES)
(Systems; Gas, Electrical)

DISCHARGE OF ENERGY OF A SUPERCONDUCTING INDUCTANCE INTO A FLASH LAMP
A.I. Bertinov, V.G. Manuilov and O.M. Mironov
Soviet Physics-Technical Physics, Vol. 16, No. 7, pp. 1136-1142 (07/1971).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1643-1651 (July 1971).
The discharge of the energy stored in a superconducting inductance into a flash lamp is analyzed. Solutions are obtained for the discharge circuit assuming linear and power-law approximations for the lamp characteristic. Equations are given for the parameters of the discharge circuit. The analysis has been verified with an IFP-200 flash lamp. The discharge is oscillatory at voltages near the lamp extinction voltage. The experimental results agree with the theory. 14 Refs.

Primary Keywords: Inductive Energy Store; Superconducting Coil; Flashlamp Load; Time Resolved Resistance

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

9453
(SWITCHES, OPENING)
(Explosive Fuses)

EXPLOSIVE SWITCHING OF AN ELECTRIC CURRENT

E.I. Bichenkov and V.A. Lobanov
Novosibirsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 16, No. 1, pp. 52-54 (02/1975).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 66-68 (January-February 1975).

Experiments are described involving a circuit-breaker element capable of switching a current with a line density of up to $3E5$ A/cm in a time of 5 microseconds. A suggested application for this device is explosive-magnetic generators with tuned back inductance. 8 Refs.

Primary Keywords: Opening Switch; Explosive Fuse; $3E5$ A/cm Line Current Density; 5 Microsecond Opening Time; Inductive Store

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

9461
(ENERGY STORAGE, INDUCTIVE)
(Systems)

INDUCTIVE ENERGY STORAGE FOR PULSED DISCHARGES

Yu.A. Anan'ev, V.M. Irtysharov, V.P. Kalinin and V.V. Serdeev
Soviet Physics-Technical Physics, Vol. 16, No. 2, pp. 283-286 (08/1971).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 376-380 (February 1971). Standard energy storage devices (capacitor banks) can be replaced by inductive storage. Details of power supplies with such devices are discussed; switching devices and switching processes are also discussed. 3 Refs.

Primary Keywords: Inductive Energy Store; Storage Coil; Switching System; Parallel Loads; Flashlamp Load; Thyristor; Explosive Fuse

COPYRIGHT: 1971 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

9503
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)
MAGNETIC FIELD COMPRESSION BY A STRONG SHOCK WAVE

A.I. Bertinov, D.A. But and V.I. Yudas
Moscow, USSR

Journal of Applied Mechanics And Technical Physics, Vol. 15, No. 3, pp. 427-429 (06/1974). Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 15, 173-175 (May-June 1974).

Compression of a magnetic field by a strong shock wave impinging on a solid wall is considered in the kinetic formulation. Variation of the magnetic field in the gap between the wall and the shock front is described by a Volterra integral equation which is solved numerically. The field distribution in gas and wall is obtained, as well as the dependence of the magnetic energy stored in them on the magnetic Reynolds number and the gas velocity in a coordinate system fixed in the shock front. Similar relations for the field and energy in the gap are also calculated. The results obtained are in good agreement with the data of other investigators. 5 Refs.

Primary Keywords: Flux Compression; Shock Wave Liner Implosion;

Theory; Numerical Calculation

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

9505
(PULSE GENERATORS; SWITCHES, OPENING)

(Flux Compression; Gas Gap; Compression)

MAGNETOIMPLOSIIVE GENERATORS FOR RAPID-RISETIME MEGAMPERE PULSES

A.I. Pal'ivovskii, V.A. Val'yukov and A.S. Russakov

Soviet Technical Physics Letters, Vol. 3, No. 8, pp. 320-321 (08/1977).

Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 789-792 (August 1977).

Recent years have seen rapid development of sources of intense current pulses that use inductive storage units in conjunction with rapid breaking of the current circuit. The most promising device for this purpose is the magnetomlopisive generator, which can produce an energy approximately $1E7$ J with a specific energy ($1-3$ $1E9$ J/cm²) and current $1E7-1E8$ A. The energy is delivered from the magnetomlopisive generator to the external load rapidly (in approximately $1E-6$ sec) by using a plasma channel to destroy a metal foil which is part of the circuit of the magnetomlopisive generator. In this letter we report an experimental study of a switch in which a rapid increase in the resistance of a plasma channel is obtained by compression by explosion products. 4 Refs.

Primary Keywords: Flux Compression Generator; Opening Switch; Plasma Compression; Opening Mechanism

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9513
(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

THE PRODUCTION OF PULSED MEGAGAUSS FIELDS BY COMPRESSION OF THE METALLIC CYLINDER IN Z-PINCH CONFIGURATION

S.G. Al'tkhanov, V.G. Belan, A.I. Ivanchenko, V.M. Karasjuk and G.N.

Institute Of Nuclear Physics, Academy of Sciences of the USSR,

Kazakhstan, USSR
Journal Of Scientific Instruments (Journal Of Physics E), Series 2, Vol. 1, No. 5, pp. 543-545 (05/1968).

The experimental apparatus is described and the experimental results are given for the production of high magnetic fields, up to 3 MG, by flux compression with metallic shell accelerated in z-pinch configuration. The experimental data are compared with computer calculations. 7 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression; 3 MG Field; Z-pinch; Experiment; Comparison With Theory

COPYRIGHT: 1958 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9517

(PULSE GENERATORS)

(Pulse Forming Lines)

A GENERATOR FOR SHAPING SINGLE HIGH-VOLTAGE NANOSECOND PULSES ACROSS AN UNMATCHED LOAD

D.I. Proskurovskii and E.B. Yankovlevich
Institute Of Atmospheric Optics, Academy of Sciences of the USSR,
Moscow, USSR
Instruments And Experimental Techniques, Vol. 16, No. 5, pp 1423-1426
(10/1973).Trans. From: Priboi i Tekhnika Eksperimenta 4, 108-111
(September-October 1973)

The construction of a generator is described which shapes single pulses having an amplitude of up to approximately 50 kV and a leading edge duration of approximately 2 ns across an unmatched load. The controlled spark gap is implemented in the form of a separate element in the commuting section. For tests at a frequency of 50 Hz the service life of a gap exceeded 1E6 operations. 5 Refs.

Primary Keywords: Transmission Line Pulse; Spark Gap; Unmatched Load;
No Reflections; 50 kV Output Voltage; 2 ns Rise Time

COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION

9518

(PULSE GENERATORS)

(Current)

A GENERATOR WHICH PRODUCES CURRENT PULSES OF UP TO 10 KA AT A VOLTAGE APPROXIMATELY 100 V

V.P. Lebedev and V.P. Voinov
Khar'kov State University, USSR
Instruments And Experimental Techniques, Vol. 18, No. 4, pp 1112-1113
(08/1973).

Trans. From: Priboi i Tekhnika Eksperimenta 4, 88-89 (July-August 1973)

A circuit for obtaining single or continuously repetitive electrical current pulses having an amplitude of up to 10 kA and a length of approximately $1E-5 - 1E-4$ sec voltage 60-450 V is described. The spark gap can withstand approximately 1E5 pulses. 3 Refs.

Primary Keywords: Pulse Generators; 10 kA Current Pulse; 100 V Output Voltage; Single Pulse; Rep-rate; Spark Gap

COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

9520

(PULSE GENERATORS)

(Marx)

A MOBILE GENERATOR OF 300 KV, 10 CPS VOLTAGE PULSES

V.S. Berantsev, I.I. Kalyatskii and R.E. Klein
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 2, pp 371-372 (04/1964).
Trans. From: Priboi i Tekhnika Eksperimenta 2, 108-109 (March-April 1964).A generator of 300 KV voltage pulses with a repetition rate of 10 cps is described. The generator uses capacitors charged through a protected choke and decoupling inductances. The voltage pulse has an energy of 800 J, and a rise time of $1E-7$ sec. 0 Refs.

Primary Keywords: Marx Generator; Arkad'ev Marx; 100 KV Output Voltage; 800 J Stored Energy; 10 ns Rise-Time; Rep Rate; 10 Hz Repetition Rate

COPYRIGHT: 1964 PLENUM PRESS, REPRINTED WITH PERMISSION

9527

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

BREAKDOWN MECHANISM OF SHORT VACUUM GAPS

G.M. Kassirov and G.A. Mesyats
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 9, No. 8, pp 1141-1145 (02/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 1476-1481 (August 1964).

From the breakdown time characteristics of vacuum gaps up to 1 mm long in the nanosecond range, and from known experimental data, a hypothesis regarding the retardation of the discharge and the process of its transition into an arc is developed. Experimental data are clearly explained within the framework of the proposition set out. 19 Refs.

Primary Keywords: Vacuum Breakdown; Experiment; Theory; 1 mm Gap Spacing; Breakdown Mechanism

COPYRIGHT: 1965 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9528

(SWITCHES, CLOSING)

(Gas Gaps, Self)

BREAKDOWN-VOLTAGE STABILITY OF GAS-FILLED SWITCHES FOR VOLTAGE PULSE GENERATOR

E.I. Zolotarev, V.D. Mukhin, L.E. Polyanovskii and V.N. Trapeznikov
Soviet Physics-Technical Physics, Vol. 21, No. 3, pp 340-344 (03/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 595-600 (March 1976).

In many applications of voltage pulse generators the system must be highly stable against spontaneous breakdown and the pulse length and repetition period must be controlled very precisely. Suitable circuits, varying in complexity, are available for this purpose. Switches with a stable breakdown voltage permit simpler solutions. 5 Refs.

Primary Keywords: Spark Gap; Breakdown Voltage Stabilization; 100 KV Operating Voltage; 60 kA Current; Reliability

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9531

(SWITCHES, CLOSING)

(Gas Gaps, Electrical)

A CONTROLLED DOUBLE-TRIGGER SPARK GAP

S.I. Lobov and M.A. Krasnov
Instruments And Experimental Techniques, No. 6, pp 1133-1135 (12/1961).
Trans. From: Priboi i Tekhnika Eksperimenta 6, 94-96
(November-December 1961).

The double-trigger principle in spark gaps operating on the right branch of Paschen's curve provides very fast action with a high safety factor. In instruments of this type at a working voltage of 1.5 KV the testing voltage is at least 3 KV, and the lag of the main discharge behind the trigger pulse does not exceed 0.05 microsecond. The spark gap is designed for a current up to 3 kA and electric pulses of several millisecond duration. 4 Refs.

Primary Keywords: Spark Gap Switch; Double-trigger Gap; Field Distortion Gap; 3 KV Operating Voltage; 50 ns

Switching Delay; 3 kA Current

COPYRIGHT: 1961 PLENUM PRESS, REPRINTED WITH PERMISSION

9534

(BREAKDOWN STUDIES; BREAKDOWN STUDIES; INSULATION, MATERIAL)

(Gas, Electrical; Electrodes; Gas) DIELECTRIC STRENGTH OF COMPRESSED SULFUR HEXAFLUORIDE AND THE ELECTRODE MATERIAL AND SURFACE STRUCTURE

B.A. Goryunov
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 66-67 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 111-114 (January 1975).

The effects of the electrode material and the methods used to finish the electrode surfaces on the ignition voltage in compressed sulfur hexafluoride have been studied. Experiments with plane-electrodes at gas pressures up to 8 atm show that the dielectric strength is a function of the mechanical strength of the electrode metal, its melting temperature, and, in particular, the technique used to finish the electrode surface. 5 Refs.

Primary Keywords: SF₆/sub 67 Insulation; Electrical Strength; Electrode Effects; Electrode Surface

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9568

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

TRANSITION FROM FIELD EMISSION TO A VACUUM ARC

G.N. Fursat and G.K. Kartsev
Leningrad State University, USSR
Soviet Physics-Technical Physics, Vol. 14, No. 10, pp 1442-1443
(Oct 1970).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 39, 1917-1919 (October 1969). The very rapid explosive transition from the comparatively low conductivity of the vacuum gap to high conductivity limited only by the parameters of the external circuit is the decisive and irreversible moment in the development of the vacuum breakdown during the destruction of the field emitter. It was our purpose to study the time characteristics of the transition during a gradual approach to the critical stage, i.e., the 'slow' transition, and for an increased rate of the supply of energy, i.e., 'forcing' (after reaching the critical stage, the amplitude of the high voltage pulse at the specimen increased discontinuously by the specified factor). Monocrystalline tungsten points were used for the investigation. 0 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown Currents; Field Emission; Arc Transition

COPYRIGHT: 1970 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9582

(SWITCHES, CLOSING; SWITCHES, CLOSING; SWITCHES, CLOSING)

(Gas Gaps, Electrical; Gas Gaps, Self; Liquid Gaps, Electrical) AMPLITUDE STABILIZATION OF HIGH-VOLTAGE PULSES USING POWERFUL COMMUTATORS

A.T. Matyushin, V.T. Matyushin, V.S. Pak, N.S. Rudenko, V.I. Tsvetkov and V.I. Smotrin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 18, No. 2, pp 469-471
(04/1975).

Trans. From: Priboi i Tekhnika Eksperimenta 2, 118-119 (March-April 1975).

The characteristics of three forms of discharge gaps are examined in order to establish the possibility of creating amplitude-stable high-voltage pulses. An amplitude stability of approximately 2% or better may in fact be obtained from one pulse to another. 6 Refs.

Primary Keywords: Spark Gap; Gas Gap; Self Trigger; Field Distortion Gap; Liquid Gap; Field Distortion Gap

COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

9583

(BREAKDOWN STUDIES)

(Surface Flashover)

AN INVESTIGATION OF PULSE FLASHOVER OF SOME SOLID DIELECTRICS IN VACUUM

I.I. Kalyatskii and G.M. Kassirov

Tomsk Polytechnic Institute, Tomsk, USSR

Soviet Physics-Technical Physics, Vol. 9, No. 8, pp 1137-1140 (02/1965).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 34, 1471-1475 (August 1964).

Pulse flashover of various solid insulating materials in high vacuum was investigated in the range of pulse durations 0.1-3.0 microseconds and interelectrode distances up to 20 mm. The pulse ratios were determined in this range of pulse durations. The pulse flashover voltage depended on the material of the specimens, the finish of the surface, and field inhomogeneity at the electrodes. 5 Refs.

Primary Keywords: Surface Flashover; Vacuum Insulation; Solid Insulation; 0.1-3.0 Microsecond Pulse Durations; <> 20 mm Interelectrode Distances; Pulsed Vacuum Spark Gaps

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9584

(PARTICLE BEAMS, ELECTRON; ENERGY STORAGE, INDUCTIVE; SWITCHES, OPENING) (Generation; Systems; Diodes; Self) ANODE FOR AN ACCELERATOR WITH AN INDUCTIVE ENERGY ACCUMULATOR

G.I. Dolgachev, F.I. Blinov and I.N. Silivkov

Instruments And Experimental Techniques, Vol. 21, No. 1, pp 11-13
(02/1978).Trans. From: Priboi i Tekhnika Eksperimenta 1, 14-16
(January-February 1978)

An analysis is made of the operation of an anode proposed by the authors for an electron-optical system with a longitudinal magnetic field, which fills the role of a current commutator and accelerating system in accelerators with inductive energy accumulators. It is shown to be possible to create an anode capable of receiving a stream of low-energy electrons without significant reflection in the accumulation mode and of emitting a beam of accelerated electrons into a gaseous volume in the acceleration mode. 4 Refs.

Primary Keywords: E-beam Generation; Inductive Energy Store; Diode Design; Anode Development; Anode-Switch Combination

COPYRIGHT: 1978 PLENUM PRESS, REPRINTED WITH PERMISSION

226

9599
(PULSE GENERATORS; POWER CONDITIONING; POWER CONDITIONING)
(Systems; Saturable Reactors; Pulse Forming Lines)
HIGH-FREQUENCY MAGNETOTHYRISTOR GENERATOR OF POWERFUL NANOSECOND PULSES
E.A. Gromov, A.N. Meshkov and V.I. Shishko
Gor'kiy Polytechnic Institute, USSR
Instruments And Experimental Techniques, Vol. 23, No. 3, pp 667-669
(06/1980).
Trans. From: *Pribory i Tekhnika Eksperimenta 3*, 118-119 (May-June 1980)
A magnetic generator for the modulation of devices of powerful pulsed electronics and optics is described. The generator system contains a thyristor generator of the inverted type, magnetic compression units based on ferrite, and shaping lines with a distributed commutator - a line segment containing a saturable magnetic substance. The repetition frequency of the rectangular output pulses is 20 kHz, the pulsed power is 1 MW, the duration is 70 nsec, the duration of the front and decay is 6 nsec, and the voltage is 3 kV. The supplying voltage is 300 V, with oil cooling. The possibility of increasing the pulsed power is discussed. 11 Refs.
Primary Keywords: Pulse Generator; Saturable Reactor Pulse Sharpening; Pulse Forming Line; Thyristor Switch; 3 kV Output Voltage; 300 V Input Voltage; Power Multiplication; Rep Rated; 20 kHz Repetition Rate
COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

9601
(PULSE GENERATORS; POWER CONDITIONING)
(Systems; Saturable Reactors)
HIGH-POWER MAGNETOTHYRISTOR PULSE GENERATOR
G.P. Gordoev, N.P. Polyskov, P.P. Rumantsev, V.V. Sinchenko and Yu.P. Yarushkin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 23, No. 5, pp 1179-1181
(10/1980).
Trans. From: *Pribory i Tekhnika Eksperimenta 5*, 117-119 (September-October 1980)
The paper describes a magnetothyristor generator which forms bipolar voltage pulses of amplitude 40 kV and a leading edge of 0.4 microseconds repeated at a rate of up to 1 kHz on a 6.25-nF capacitor. 5 Refs.
Primary Keywords: Pulse Generator; Saturable Reactor Pulse Sharpening; Thyristor Switch; Unipolar Output; Bipolar Output; Loss Analysis; 40 kV Output Voltage; Rep Rated; 1000 Hz Repetition Rate
COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

9604
(PULSE GENERATORS)
(Linear Amplifiers)
HIGH-VOLTAGE LINEAR PULSE AMPLIFIER
P.A. Ekstrom, D.A. Crosby and K.B. MacAdam
University of Kentucky, Lexington, KY 40506
The Review of Scientific Instruments, Vol. 51, No. 12, pp 1700-1703
(12/1980).
This linear amplifier employs moderate-voltage power supplies and components to generate high-voltage pulses of arbitrary shape on a microsecond time scale. A linear version of the Marx generator, it is limited to a small duty fraction, but can deliver a large multiple of its supply voltage. Its initial application uses generation of specially shaped field-ionization pulses in studies of Rydberg atoms. 3 Refs.
Primary Keywords: Pulse Amplifier; Linearized Marx Generator; Low Duty Factor; 5 kV Output Voltage
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9606
(PULSE GENERATORS)
(Line Type)
HIGH-VOLTAGE SQUARE-PULSE GENERATOR WITH ENHANCED PULSE-TOP STABILITY
V.G. Filippov
Instruments And Experimental Techniques, Vol. 24, No. 1, pp 125-126
(02/1981).
Trans. From: *Pribory i Tekhnika Eksperimenta 1*, 120-122 (January-February 1981)
The paper describes a high-voltage square-pulse generator made of four connected five-section twin shaping lines, commutated by a controlled multigap discharger. The stability of the pulse top is enhanced by delaying the connection of two of the shaping lines. The voltage across the load is 400 kV, the pulse duration is 70 microseconds, and the current is up to 1.5 kA. The pulse-top irregularity was $\leq 1\%$. 3 Refs.
Primary Keywords: Pulse Generator; Twin Pulse Shaping Line; Five-section Line; Four Interconnected Lines; 400 kV Output Voltage; 1 Per Cent Pulse Drop; 70 Microsecond Pulse Duration
COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

9612
(PULSE GENERATORS)
(Trigger)
LIGHT CONTROL-PULSE DETECTOR FOR THE CURRENT SWITCHES IN A HIGH-VOLTAGE PULSE GENERATOR
V.N. Eliseev, N.A. Ivanov and V.F. Kondakov
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 150-153
(02/1980).
Trans. From: *Pribory i Tekhnika Eksperimenta 1*, 149-151 (January-February 1980)
A light-pulse detector immune to interference is described for an optoelectronic control system for the effectors for the charging-current switching in a pulse generator. The threshold for the light pulse is 50 lumen. The permissible parameters for interfering pulses at the supply terminals are amplitude 12 V and duration 100 microseconds. The device is powered from the high-voltage circuits. 2 Refs.
Primary Keywords: Trigger Pulse Generator; Optical Trigger; Spiral Generator; Phototransistor; Pulse Transformer; 100 kV Output Voltage; Theory; Experiment
COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

9635
(PULSE GENERATORS; SWITCHES; CLOSING; POWER CONDITIONING)
(Systems; Thyatron; Saturable Reactor)
THYRATRON GENERATOR OF HIGH-POWER NANOSECOND PULSES WITH INCREASED EFFICIENCY
V.A. Vizir', N.A. Lashuk, V.P. Orel and V.P. Shcherbinin
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 22, No. 4, pp 1846-1849
(04/1979).
Trans. From: *Pribory i Tekhnika Eksperimenta 4*, 158-160 (July-August 1979)
A circuit of a thyatron generator for short pulses with increased efficiency and decreased commutator-current overload coefficient has been described. The generator according to this circuit using a TG11-2500/50 thyatron with a pulse power of 25 MW and a duration of 50 nsec achieves an overload coefficient of approximately 1.5, the pulse power efficiency is approximately 0.8, and the average power efficiency is approximately 0.3. 6 Refs.
Primary Keywords: Pulse Generator; Thyatron Switch; Nonlinear Ferrite Filter; Filter Capacitor; High Transfer Efficiency
COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

9643
(SWITCHES; CLOSING)
(Hollow-cathode)
A TWO-CHAMBER HEAVY-CURRENT HIGH-VOLTAGE SWITCH
O.G. Bespalov, A.S. Knyazev, A.I. Nestyukha, P.A. Smirnov and A.M. Udrovenco
Instruments And Experimental Techniques, Vol. 18, No. 1, pp 125-126
(02/1975).
Trans. From: *Pribory i Tekhnika Eksperimenta 1*, 113-114 (January-February 1975)
A description is given of a switch that will handle currents of about 500 kA at 1-20 kV with a length of 5-100 microseconds for the first half-cycle in the pulse and a repetition frequency of 0.1 Hz; the device works with residual gas at 3-8E-2 Torr. A study has been made of the gas composition. 5 Refs.
Primary Keywords: Hollow Cathode Arc Switch; 20 kV Operating Voltage; 500 kA Current; Two-chamber Switch; Copper Anode
COPYRIGHT: 1975 PLENUM PRESS, REPRINTED WITH PERMISSION

9649
(BREAKDOWN STUDIES; ELECTROMAGNETIC FIELD GENERATION)
(Exploding Wires; Magnetic)
ELECTRICAL EXPLOSION OF THE SKIN LAYER
V.P. Gordienko and G.A. Shnaerson
Soviet Physics-Technical Physics, Vol. 9, No. 2, pp 296-297 (08/1964).
Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 34, 376-378 (February 1964)
The destruction of single-turn solenoids due to the ejection of molten metal from the skin layer as it is heated by the current pulse constitutes one of the difficulties met in using such solenoids to produce rapidly increasing magnetic fields. Thus destruction of the solenoid takes place before plastic deformation can ensue, and occurs the more violently the faster the field rises. We have studied the 'slow explosion' of the skin layer using single-turn solenoids of Wood's alloy, when violent destruction occurs at moderate fields and on the leading edge of the current pulse; in solenoids of conventional materials (copper, steel, etc.) and at induction amplitudes of 120-150 Wb/cm², this process begins after the first current maximum, other things being the same. 6 Refs.
Primary Keywords: Magnetic Field Generation; Coil Destruction; Skin Layer Explosion; Fast-rise Fields
COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9650
(ENERGY STORAGE; INDUCTIVE; SWITCHES; OPENING)
(Systems; Explosive Fuses)
ENERGY TRANSFER FROM AN INDUCTIVE STORAGE TO AN INDUCTIVE LOAD BY MEANS OF AN EXPLOSIVE CURRENT DISCONNECT
L.S. Gerasimov, V.I. Ikryannikov and A.I. Pinchuk
Novosibirsk, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 16, No. 1, pp 45-46 (02/1975).
Trans. From: *Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki* 1, 55-59 (January-February 1975)
A study is made of switching of current from an inductive storage by electrical explosion of a wire shunting an inductance in conformity with a model based on surface vaporization waves. It is established that the nature of the process is determined by certain generalized dimensionless parameters of the system. The modes of most efficient transfer of energy to the load are determined. 4 Refs.
Primary Keywords: Inductive Energy Store; Inductive Load; Opening Switch; Exploding Wire; Explosion Modeling; Efficiency Considerations
COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

9651
(BREAKDOWN STUDIES)
(Exploding Wires)
EXPLOSION OF A METAL BY AN ELECTRIC CURRENT
S.V. Lebedev
P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics JETP, Vol. 5, No. 2, pp 243-252 (09/1957).
Trans. From: *J. Exptl. Theoret. Phys. (U.S.S.R.)* 32, 199-207 (February 1957)
The destruction of metal wire at currents of 5E5 x 5E6 amp/cm² was investigated. Two different types of processes were observed: rupture of the melted wire into macroscopic fragments by surface tension forces, and explosion of the melted wire caused by changes in its volume properties. The abrupt change in the electrical conductivity of melting tungsten, molybdenum, platinum, or nickel was measured. A previous conclusion, that the energy of the metal at which its electric conductivity vanishes depends on the current density, is confirmed. 19 Refs.
Primary Keywords: Exploding Wire; Tungsten Wire; Molybdenum Wire; Platinum Wire; 5E5 A/cm²; Current Density; Conductivity Change; Several Explosion Regimes
COPYRIGHT: 1957 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9660

(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Surface Flashover; Gas, Optical)A.G. Bedrin, V.E. Levrentyuk, I.V. Podmoshenskii and P.N. Rogovtsev
Soviet Physics-Technical Physics, Vol. 24, No. 10, pp 1181-1185
(10/1979)Trans. From: Zhurnal Tekhnicheskoi Fiziki 49, 2146-2152 (October 1979)
The surface discharge at a dielectric surface illuminated by a xenon flashlamp is studied. The breakdown field is two orders of magnitude lower than that for a conventional surface discharge. There is a threshold irradiance below which a surface discharge does not occur. A direct relation exists between the discharge and the appearance of a vapor layer at the surface. The discharge delay time is found as a function of the irradiance and the electric field. At the threshold electric field the delay time is much longer than the light flash. Various factors which contribute to the photoinduced surface discharge are discussed. 14 Refs.Primary Keywords: Surface Flashover; Xenon Flashlamp Illumination;
Effect On Flashover Voltage; Surface Vapor Layer;
Delay MeasurementCOPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

9675

(BREAKDOWN STUDIES; SWITCHES, OPENING)
(Exploding Wires; Explosive Fuses)

USE OF AN EXPLODING WIRE AS A CURRENT COMMUTATOR

Yu.A. Aran'ev and V.P. Kalinin
Instruments And Experimental Techniques, No. 5, pp 1164-1166 (10/1968).
Trans. From: Pribory i Tekhnika Eksperimenta 4, 140-142
(September-October 1968)Powerful electrical discharges through a conductor are characterized by the presence of a so-called 'current pause' stemming from the large resistance of the high-pressure plasma formed upon explosion of the conductor. This phenomenon leads to the possibility of using an exploding wire (or foil) as a fast acting current commutator. Such conductors are used presently mainly for fast transmission of magnetic energy to an inductive load and for protection of a capacitor bank against discharge to the disrupted section of the bank. In this article we present information on the operation of a commutator which is based on an exploding wire with a comparatively long current-redistribution time, about 100 microseconds. A capacitor bank with a capacitance of 2 or 3.5 mF served as the current source in the charging inductance circuit $L=0.475 \text{ mH}$, and the discharger acted as the switch. The currents in the charging and discharging circuits were measured by means of shunts. A powerful IFF xenon flashtube was used as the nonlinear load. A long duration of the redistribution of the currents was secured by a high resistance of the tube at the initial stage of discharge. We note that when using this system of admitting energy to the tube, the discharge in it develops in the presence of a rapidly varying voltage equal to the voltage at the commutator and determinable by the properties of both the tube and commutator. 0 Refs.

Primary Keywords: 5

Secondary Keywords: Exploding Wire; Opening Switch; Current Pause; 100
Microsecond Opening Time; Flashlamp Load; Copper
Wire

9695

(INSULATION, VACUUM)
(Reviews)VACUUM ELECTRICAL INSULATION. PRINCIPAL PROPERTIES AND RESEARCH PROBLEMS
I.N. Sivkov
Power Engineering, Vol. 13, No. 1, pp 19-29 (01/1975).Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 13,
24-36 (1975)

The viability and desirability of vacuum insulation are discussed in this paper. The author points out that vacuum insulation can theoretically withstand voltage gradients of over 5 MV/mm, is self healing, and displays a conditioning. Areas for future work are pointed out. 13 Refs.

Primary Keywords: Vacuum Insulation; Review; Vacuum Insulation
Properties; Present Performance Limitations; Future
Performance Improvement

COPYRIGHT: 1975 ALLERTON PRESS, INC.

9696

(POWER CONDITIONING)
(Saturable Reactors)THREE-DIMENSIONAL ANALYSIS OF THE MAGNETODYNAMIC FIELDS IN
ELECTROMAGNETIC DEVICES TAKEN INTO ACCOUNT THE DYNAMIC HYSTERESIS LOOPS
Y. Saito
Hosei University, Tokyo, Japan
IEEE Transactions On Magnetics, Vol. MAG-18, No. 2, pp 546-551
(05/1982)

A new magnetic field equation exhibiting dynamic hysteresis loops is proposed. Based on this magnetic field equation, a system of two-dimensional magnetic circuit equations taken into account the dynamic hysteresis loops is derived by the method of magnetic circuit. By means of magnetic power invariant transformation, a system of two-dimensional magnetic circuit equations is transformed into a system of three-dimensional magnetic circuit equations. This system of three-dimensional magnetic circuit equations is discretized in time by a finite difference method. A system of three-dimensional magnetic circuit equations discretized in time is solved by a simple iteration method, using a relaxation parameter. As an example, a system of three-dimensional magnetic circuit equations of a simple saturable reactor is derived. Also, the numerical solutions of dynamic hysteresis loops in a saturable reactor are presented together with those of experimental results. 6 Refs.

Primary Keywords: Saturable Reactors; Dynamic Hysteresis Loop; Theory;
Numerical Calculation; Magnetic Circuit Model

COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

9697

(ELECTROMAGNETIC FIELD GENERATION; REVIEWS AND CONFERENCES)
(Magnetic Conferences)CONFERENCE ON MEGAGAUSS MAGNETIC FIELD GENERATION BY EXPLOSIVES AND
RELATED EXPERIMENTSH. Kroenfel (Ed.) and F. Herlach (Ed.)
Publisher: European Atomic Energy Community (Euratom), Brussels
(07/1986)

This conference record contains 27 papers relating to the generation of very high magnetic fields. Explosive compression of a weak field is the chief method considered. Several papers consider the effects of these fields upon materials and the generating apparatus. There is also a brief session concerning explosive MHD generators. 279 Refs.

Primary Keywords: Magnetic Field Generation; Flux Compression
Generators; Materials Interaction; Explosive MHD
Generator; Current Amplification

COPYRIGHT: 1984 EUROPEAN ATOMIC ENERGY COMMUNITY

9700

(ENERGY STORAGE, INDUCTIVE)
(Systems)

MATCHING OF AN INDUCTIVE ENERGY STORE AND A COIL WITH LINER WITH

LIMITING OF BREAKING VOLTAGE

E.A. Zotova, I.A. Ivanov, A.P. Lototskii and V.A. Trukhin
Power Engineering, Vol. 16, No. 6, pp 7-11 (01/1978).Trans. From: Izvestiya Akademii Nauk SSSR. Energetika i Transport 16,
9-14 (1978)An inductive energy storage system is described for powering a metallic liner driver. The mismatch of generator and load impedances is considered quantitatively and limits are placed on that mismatch. The peak discharge voltages are calculated as a function of impedance mismatch and its effect on liner acceleration is considered. 4 Refs.
Primary Keywords: Discharge-pulse Voltage; Inductive Energy Store;
Liner Acceleration System; Peak Discharge-pulse
Voltage; Limiting Parameters; Impedance Mismatch

COPYRIGHT: 1978 ALLERTON PRESS, INC.

9701

(BREAKDOWN STUDIES)

(Gas, Electrical)

THE PHYSICS OF HIGH-VOLTAGE NANOSECOND DISCHARGES IN DENSE GASES

L.P. Babich, T.V. Lotko and L.V. Teresova
Radiophysics And Quantum Electronics, Vol. 20, No. 4, pp 436-442
(04/1977).Trans. From: Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika 20,
637-645 (April 1977)The article sets forth the results of experimental investigations of nanosecond electrical discharges in air at atmospheric pressure in fields with an intensity of 10^5 V/cm . Information is obtained on voltage pulses, attained during a discharge, on the conductivity currents in the discharge gap, and on the light emission of different regions of the discharge. It is shown that electrons with energies exceeding the applied voltage are generated in accordance with the rise in the conductivity current. A conclusion is drawn with respect to the determining role of 'runaway' electrons in the development of discharges. 35 Refs.Primary Keywords: Gas Breakdown; Air Breakdown; Atmospheric Pressure;
Voltage Measurement; Current Measurements; Light
Emission Measurement; Theory; Runaway Electrons

COPYRIGHT: 1977 PLenum Press, REPRINTED WITH PERMISSION

9702

(PARTICLE BEAMS, ELECTRON; SWITCHES, OPENING; ENERGY STORAGE, INDUCTIVE)
(Generation; Explosive Fuses; Systems)

DIRECT-ACTION ACCELERATORS WITH INDUCTIVE ENERGY STORAGE AND EXPLODING

CONDUCTORS

Yu.D. Bakulin, V.S. Divankov, V.P. Kovaliov, A.I. Kormilitsyn, B.N.
Levant'ev, A.V. Luchinskii and V.I. Martynov
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 325-327
(04/1979).Trans. From: Pribory i Tekhnika Eksperimenta 2, 34-37 (March-April
1979)

Two generators of pulsed bremsstrahlung and electron beams are described, the IGUR-I and IGUR-II instruments, in which inductive storage devices with exploding conductors are used. At a voltage of 2.8 MV on the accelerator tube and a current of 44 kA through the tube the IGUR-I provides a bremsstrahlung dose of 110 R at a distance of 1 m from the anode, while the IGUR-II at a voltage of 3.7 MV on the tube and a current of 70 kA provides a dose of 700 R. On both tubes and a half-width of the bremsstrahlung pulse is regulated in the range of 0.1-0.5 microseconds. Electron beams with an energy density of 500 J/sq.cm. are extracted from the accelerator tubes. 6 Refs.

Primary Keywords: Field Emission Diodes; Direct-action Accelerators;
Exploding Wire; 300 J/sq.cm. Energy Density;
High-voltage Pulse Generator; Inductive Energy
Storage; Magnetohydrodynamic Calculations; Reduced
Electromagnetic Induction

Secondary Keywords: Bremsstrahlung Radiation Generation

COPYRIGHT: 1979 PLenum Press, REPRINTED WITH PERMISSION

9704

(ENERGY STORAGE, CAPACITIVE)

(Capacitor Banks)

EFFECT OF ELEMENT DISTRIBUTION IN A CAPACITOR BANK ON THE CURRENT PULSE
IN A PULSED PLASMA INJECTORN.V. Belan, M.A. Mashtakov, I.P. Panachevnyi and L.V. Shushlyapin
Kharkov Aviation Institute, USSRSoviet Physics-Technical Physics, Vol. 18, No. 6, pp 749-751 (12/1973).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 1179-1183 (June 1973)

A system of equations is derived for the operation of a pulsed plasma injector whose capacitor bank consists of distributed elements. The amplitude and length of the current pulse in the injector are analyzed as functions of the element distribution in the bank. 5 Refs.

Primary Keywords: Distributed-element Capacitor Banks; Plasma Gun; Bank

Analysis; Analytical Solution

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

9705

(PULSE GENERATORS)

(Line Type)

SYSTEM FOR TWO-PULSE SUPPLY OF A LARGE STREAMER CHAMBER

V.V. Govorov, V.A. Davidenko, B.A. Dolgochein, V.A. Kantsarov, A.N.
Lebedev and S.V. Samov

Moscow Engineering-Physics Institute, Moscow, USSR

Instruments And Experimental Techniques, Vol. 19, No. 1, pp 32-34
(02/1976).Trans. From: Pribory i Tekhnika Eksperimenta 1, 32-34
(January-February 1976)A high-voltage circuit for supplying a streamer chamber with two pulses spaced in time is described. Two-pulse supply is used to achieve brightness separation of muon and e- tracks during the recording of muon decay in the streamer chamber used on the proton synchrotron of the Institute of High-Energy Physics. 5 Refs.
Primary Keywords: Pulse Supply System; 800 KV Amplitude; High-voltage
Pulse; Marx VPC Generator; Track Brightness;
Stabilization System

Secondary Keywords: Streamer Chamber

COPYRIGHT: 1976 PLenum Press, REPRINTED WITH PERMISSION

9784
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines, Materials)

HIGH-CURRENT BRUSHES. PART IV: MACHINE ENVIRONMENT TESTS
J.L. Johnson and O.S. Taylor
Westinghouse Research and Development Center, Pittsburgh PA
IEEE Transactions On Components, Hybrids, And Manufacturing Technology,
Vol. CHMT-3, No. 1, pp 31-36 (03/1980).

Brush performance has been investigated with a view to establish whether or not continuous very high-current density operation is feasible for many parallel brushes running under machine environment conditions. The ultimate objective is the development of sliding-brush contact systems for advanced power electrical machines that require large currents in order to achieve high efficiencies and small volumes. Using a homopolar generator designed for that purpose, the performance of a full complement of 92 brushes was evaluated under conditions that included electrical loads to 9500 A (1.6 MA/sq.m.) and a slipping speed of 2 m/s. Based on test data normalized geometrically, the slip ring and cathode brush electric contact resistances and wear rates of about 2:1 were found. Under the maximum imposed load conditions, the anode and cathode brush interface contact voltage drops are 0.17 and 0.08 V, respectively. Typically, the highest dimensionless linear wear rate (anode brush) is < 1.7E-11. This wear rate is about one-sixth that of diesel-electric locomotive motor brushes, which slide on contact surfaces of similar peripheral speed but with less than one-tenth the electrical load imposed here. The high feasibility demonstrated for multiple-brush high-current operation is attributed to the use of silver-graphite brushes (0.75 mass fraction silver), a nonair (e.g., humidified carbon dioxide) environment, and cooling of the brush holders and slip rings. 7 Refs.

Primary Keywords: High-Current Brushes; Machine Environment Conditions; 1.6 MA/sq.m.; Electrical Loads; 2 m/s Slip Ring Speed; < 1.7E-11 Linear Anode Brush Wear Rate; Contact Voltage Drop; 2:1 Anode and Cathode Brush-to-Ring Contact Resistance

9785
(BREAKDOWN STUDIES)
(Exploding Wires)

MECHANISM FOR INTERRUPTION OF CURRENT FLOW AND PRODUCTION OF SHOCK WAVES IN A METAL HEATED BY HIGH-DENSITY CURRENT PULSES
N.A. Protopopov and V.M. Kul'gavchuk
Soviet Physics-Technical Physics, Vol. 6, No. 5, pp 399-404 (11/1961).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 31, 557-564 (May 1961).

One of the most complicated unsolved problems in the heating of a metal is the interruption in current flow and the relation of this effect to the shock waves which are observed experimentally. In the present work we have investigated explosions of wires characterized by a high rate of energy introduction. In order to indicate the rate at which the process takes place, we may say that in the present experiments the time of the first pulse (until the final current interruption) varies from 2E-7 to 1.5E-6 sec while the total length of the explosion process (except for cases in which low voltages are used) is less than 4 microseconds. 9 Refs.

Primary Keywords: Exploding Wires; Current Interruption; Shock Wave; Tungsten Wire; Air Environment; Glass Environment

COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9742
(POWER TRANSMISSION)
(Cables)

RESISTANCE OF METALS AT HIGH CURRENT DENSITIES
V.V. Bondarenko, I.F. Kvartskha, A.A. Pliutto and A.A. Chernov
Soviet Physics-JETP, Vol. 11, No. 2, pp 221-222 (09/1955).
Trans. From: Izv. Akad. Nauk SSSR 28, 191-192 (1955).

Results are given of an investigation of the dependence of resistance of a few metals on current density. Comparison is made of experimental curves, presenting the dependence of resistance for copper, silver, platinum and other metals on the amount of energy introduced, with curves and calculations from tabulated data. For these metals, Ohm's law is maintained up to current densities of about 1E7 A/sq.cm. 7 Refs.

Primary Keywords: High-current Cable; Cable Resistivity; Resistivity vs Current; Copper; Silver; Platinum
COPYRIGHT: 1955 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9748
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE DEVELOPMENT OF THE SPARK DISCHARGE
T.E. Allibone and J.H. Meek
Proceedings Of The Royal Society Of London, Vol. A166, No. A924, pp 97-126 (05/1938).

Pulsed gas breakdown with several electrode geometries is the subject of this paper. Point-plane, point-point; sphere-point, and sphere-plane electrode configurations are considered with both polarities used for each configuration. The velocity of the leader and main stroke are measured photographically for each case and reported. Multiple strokes are considered. 23 Refs.

Primary Keywords: Gas Breakdown; Long Spark; Several Electrode Geometries; Point Electrode; Plane Electrode; Leader Velocity; Spark Velocity

COPYRIGHT: 1938 ROYAL SOCIETY OF LONDON

9757
(ELECTROMAGNETIC FIELD GENERATION; ENERGY STORAGE; PULSE GENERATORS)
(Magnetic; Reviews; Reviews)

A METHOD OF PRODUCING STRONG MAGNETIC FIELDS
P.L. Kapitza
Cavendish Laboratory, Cambridge
Proceedings Of The Royal Society Of London, Vol. 105, No. A734, pp 691-710 (06/1924).

This paper provides a review of energy storage techniques known at this time. Capacitive, inductive, and flywheel stores are all discussed with the inherent limitations and practical difficulties pointed out. Switching problems and diagnostic systems are discussed. The generation of magnetic fields to 500 kG are shown to be feasible by using the described methods. 2 Refs.

Primary Keywords: Energy Storage; Review; Capacitive Store; Inductive Store; Mechanical Store; Switch; Explosive Fuse; Magnetic Field Generation; Solenoid

COPYRIGHT: 1924 ROYAL SOCIETY OF LONDON

9762
(BREAKDOWN STUDIES)
(Exploding Wires)

ELECTRONIC SHUTTER PHOTOGRAPHS OF EXPLODING BRIDGE WIRES
W.A. Allen, C.H. Hendricks, E.B. Mayfield and F.N. Miller
Michelson Lab, China Lake, CA
The Review Of Scientific Instruments, Vol. 24, No. 1, pp 1068-1069 (11/1953).

The experiment reported in this note is intended to yield some idea of the macroscopic and microscopic phenomena associated with an exploding bridge wire during the first few microseconds of the event. 8 Refs.

Primary Keywords: Exploding Wire; Bridge Wire; Photographic Diagnostic; Repetronic Shutter; High Temporal Resolution

COPYRIGHT: 1953 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9785
(BREAKDOWN STUDIES)

(Exploding Wires)

VISUALIZATION OF CYLINDRICAL SHOCK WAVES
F.D. Bennett and D.D. Shear
Army Armament Research and Development Command, Aberdeen Proving Ground, MD 21005

The Physics Of Fluids, Vol. 2, No. 3, pp 338-339 (06/1959).

In a previous paper a method of mirror back-lighting is introduced to make visible the cylindrical shock wave formed by an exploding wire. The present note offers an alternative scheme which has the advantage of tracing the path of the shock wave over a longer interval of time than in the earlier method. 1 Refs.

Primary Keywords: Exploding Wire; Shock Wave; Diagnostics; Backlit Mirr. Light; Observation Time

COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9786
(ELECTROMAGNETIC COMPATIBILITY)

(Hardness)

ELECTROMAGNETIC VULNERABILITY (EMV) TESTING OF AIR LAUNCHED VEHICLES
V. Morets
Wright-Patterson AFB, OH

IEEE 1981 National Aerospace And Electronics Conference, pp 688-690 (05/1981).

The electromagnetic environment from military emitters, worldwide, has increased significantly in the past two decades. It is anticipated there will be further increases as new high-powered radar systems and other emitters are introduced into defense inventories. This paper addresses the need to consider the effect of these environments in the design of missile systems and the testing that is required to insure hardness. The new family of cruise missiles and tactical air launched missiles are typical of the systems where EMV must be a major consideration. The author also discusses operational environments, test facilities, instrumentation and EMV hardening. 7 Refs.

Primary Keywords: EMP; System Hardening; Environment Characterization; Test Chamber

Secondary Keywords: Missile Systems

COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION

9787
(ELECTROMAGNETIC COMPATIBILITY)

(Lightning)

A RECURSIVE TIME DOMAIN ANALYSIS OF DISTRIBUTED LINE GRID NETWORKS WITH APPLICATION TO THE LTA/EMP PROBLEM
H.S. McCormick
Wright State University, Dayton, OH 45435

IEEE 1981 National Aerospace And Electronics Conference, pp 783-788 (05/1981).

Modeling the aircraft fuselage as a two-node, TEM, lossy distributed network, a recursive time domain technique is presented to estimate the fuselage skin-current induced by a remote lightning strike. The technique involves the determination of the two discrete nodal transfer functions followed by an application of Duhamel's theorem to the distributed electromagnetic excitation case. The Fourier transformer of the induced fuselage skin-current is presented as a function of the azimuth and elevation angles of the incident plane electromagnetic lightning excitation. Reference to the PORTER and NOAA flight programs is made along with a discussion of future application areas. 2 Refs.

Primary Keywords: Distributed Network; Modeling; Lightning Effect; Theory

Secondary Keywords: Aircraft Shielding

9788
(ELECTROMAGNETIC COMPATIBILITY)

(Lightning)

ASSESSMENT METHODOLOGY OF THE LIGHTNING THREAT TO ADVANCED AIRCRAFT
R.A. Perera (1) and G.A. Dubro (2)

(1) Electromagnetic Applications, Inc., Denver, CO

(2) Wright-Patterson AFB, OH

IEEE 1981 National Aerospace And Electronics Conference, pp 691-697 (05/1981).

One research and development area of primary interest to the avionics community is that of assessment methodology for lightning vulnerability. The work in this area is concentrated on increasing the general understanding of the physics of the aircraft-lightning interaction and on developing specific laboratory threat simulation testing techniques. This area has two complementary facets: testing/simulation and analytics. The prime objective of the assessment methodology activity is to provide design inputs for aircraft protection as well as for qualification for safety of flight. In this paper, recent advancements are discussed in both facets-testing/simulation and analytics. These advancements have been made possible with the incorporation of nuclear electromagnetic pulse technology and recent indications from measurements of natural lightning that suggest significantly greater electromagnetic energy exists in the frequency range where increased coupling efficiency of such energy is possible to the aircraft. 19 Refs.

Primary Keywords: Lightning; Synthesis; Waveform Synthesis; Laboratory Simulation

Secondary Keywords: Aircraft Hardening

COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION

**9789
(ELECTROMAGNETIC COMPATIBILITY)**

(Grounding And Shielding)

THE NAVY FA-18A HORNET ELECTROMAGNETIC COMPATIBILITY PROGRAM
J.R. Kettner (1) and J.J. Fisher (2)
(1) McDonnell Aircraft Co., St. Louis, MO 63166
(2) Naval Air Systems Command, Washington, DC 20361

IEEE 1981 National Aerospace And Electronics Conference, pp 698-702
(05/1981).

The FA-18A Hornet is a first line carrier-deployed aircraft employing advanced composite structures and state-of-the-art digital electronics including a digital fly-by-wire flight control system. Because the electromagnetic environment (EME) generated on present day carrier decks can reach field strengths over 10,000 Volts/meter at some frequencies, electromagnetic compatibility (EMC) challenges were presented. The approach to aircraft EMC design established for the FA-18A used the airframe as an enclosed electromagnetic (EM) shield. This shielding concept allowed equipment located within the airframe shield to be designed to a less severe EM environment than equipment located outside the airframe shield (e.g. the cockpit or wheel wells). Using the airframe as an electromagnetic shield presented a significant challenge, particularly because graphite/epoxy (Gr/Epo) composites represent more than one-third of the FA-18A surface area. Overall, this concept was found to represent the least cost, weight, and design impact both to the airframe and to the electrical or electronics equipments. 1 Refs.

Primary Keywords: RF Shielding; Design Considerations; Materials Study; Performance Testing

Secondary Keywords: Aircraft Shielding

COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION

**9790
(SWITCHES, OPENING)**

A HALF CYCLE AIR BLAST GENERATOR BREAKER FOR HIGH POWER TESTING FIELDS
K. Kriechbaum
Allgemeine Elektricitäts-Gesellschaft, AEG-TELEFUNKEN

Hochspannungsschaltgerätefabrik, Kassel, FRG

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-91, No. 3,

pp 747-752 (06/1972).

Generator breakers in high-power testing fields, the back-up breakers, have the function of safety breakers, they have to protect both the generator and the test breaker from being overstressed by a short-circuit current of undesired duration. The heavy short-circuit currents of modern generators reinforce the development of generator circuit-breakers of high breaking capacity. In this paper, a generator c.b. is described having a rated breaking capacity of 160 kA at a service voltage of 15.4 kV. This circuit-breaker is a half-cycle breaker capable of interrupting a symmetrical current at the first current zero passage. Due to its short minimum arcing time this breaker is suitable for synchronized breaking operations and so permits an economical testing of circuit-breakers. This testing method is also described. 7 Refs.

Primary Keywords: Circuit-breakers; High Power Testing Fields; 160 kA Breaking Capacity; 15.4 kV Service Voltage; Power Line Frequency

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

**9791
(PULSE GENERATORS; ENERGY STORAGE, CAPACITIVE)**

(Capacitor Banks; Capacitors)

A PULSE GENERATOR FOR SHORT MEGAVOLT PULSES WITH A RISETIME IN THE NANOSECOND REGION

N.R. Nilsson, L. Hogberg, A. Svedberg and J. Hippel

Research Institute of National Defense, Stockholm, Sweden

Physica Scripta, Vol. 1, pp 193-196 (01/1970).

The design of a Marx-Goodlet pulse generator is described. Circular plate capacitors are used to produce a fast rise 20 ns duration pulse at voltages up to 1.2 MV and load impedances from 40 to 120 ohms. The diagnostics used to characterize the generator are also described. 8 Refs.

Primary Keywords: Megavolt Pulse Generator; 20 Nanosecond Voltage Pulse Duration; Circular Plate Capacitors; Center Discharge; 1.2 MV Output Voltage

COPYRIGHT: 1970 ROYAL SWEDISH ACADEMY OF SCIENCES

**9792
(BREAKDOWN STUDIES)**

(Gas, Optical)

ELECTRICAL DISCHARGE IN NITROGEN AND SULFUR HEXAFLUORIDE IN A UNIFORM FIELD

A.S. Perlin

D.V. Efremov Institute, Leningrad, USSR

Soviet Physics-Technical Physics, Vol. 17, No. 5, pp 813-817 (11/1972).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 52, 1027-1032 (May 1972). Electrical discharges in nitrogen and sulfur hexafluoride due to photoelectric processes in a uniform field are considered for pressures $p \geq 760$ mm Hg with gaps greater than 0.1 cm. On the basis of the experimental and theoretical data, the conditions for a change in the discharge mechanism are determined. The dependence of the critical gas density (at which the transition to a streamer mechanism takes place) on the discharge gap is also obtained. 14 Refs.

Primary Keywords: Gas Breakdown; Nitrogen; SF₆; Uniform Field; Photoelectric Process; Discharge Mechanism

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**9797
(PULSE GENERATORS; PARTICLE BEAMS, ELECTRON)**

(Line Type; Generation)

DEVELOPMENT OF 36-MEGAWATT MODULATORS FOR THE ASTROM 1000-MEGAWATT ELECTRON ACCELERATOR

V.L. Smith

Lawrence Livermore Lab, Livermore, CA 94550

IEEE Transactions On Nuclear Science, Vol. NS-9, No. 2, pp 57-67
(04/1962).

An 1000 megawatt peak power linear electron accelerator is required for the injection of electrons into a thermonuclear fusion experimental device called the Astrom, which is now under construction at the Lawrence Radiation Laboratory in Livermore, California. The Astrom will determine the feasibility of an actual power-producing fusion reactor utilizing the principles of confinement and heating of a plasma by establishing a long rotating layer of relativistic electrons. The linear electron accelerator under construction is designed to produce a pulsed electron beam with an energy of 5 Mev $\pm 0.5\%$, a pulse current of 200 amperes, with a pulse duration of 0.25 microseconds and at 60 pulses per second. The accelerator will be of the induction type utilizing large magnetic cores. Approximately 400 cores will be used and each one will contribute a minimum acceleration of 12,000 volts. The details of the design and development of a 1-line-type modulator used for pulsing cores and capable of an output peak power of 36 megawatts will be discussed in detail. A type 6587 arrester type 5949A thyristors were used. Life tests at 32 kV, 2000 amperes and 60 Hz showed useful life in excess of 10,000 hours was obtained. In addition, it was necessary to develop corona-resistant connectors for this application. Life data and final design for a small connector suitable for operation at 16-kV, 0.4-microseconds (70% amplitude points) pulses with 60-nanosecond rise time, and at 60 pps are presented. 15 Refs.

Primary Keywords: 36-megawatt Modulator; 1000-megawatt Linear Electron Accelerator; 5 Mev Pulsed Electron Beam Energy; 200 Amperes Pulse Current; 0.25 Microsecond Pulse Duration; Accelerating Induction Electric Field; Thermonuclear Fusion

COPYRIGHT: 1962 IEEE, REPRINTED WITH PERMISSION

**9799
(BREAKDOWN STUDIES)**

(Exploding Wires)

ELECTRICAL EXPLOSION OF METAL WIRES

I.F. Kvarckhtsava, A.A. Pljutko, A.A. Chernov and V.V. Bondarenko

Soviet Physics JETP, Vol. 3, No. 1, pp 40-51 (08/1956)

Trans. From: J. Exper. Theoret. Phys. USSR 30, 42-53 (January 1956). Shadow photography and oscillograms of the current and voltage are used to investigate wires exploded by electric current. It is shown that the energy liberated in the wire at the instant of the first current pulse is sometimes less than the energy needed to evaporate the wire fully, and sometimes considerably more. Shadow photographs of the successive stages of wire explosion show a strong dispersion of the wire material after the flow of the first current pulse. A qualitative description is given of the basic features of the wire explosion phenomenon, taking into account the high mechanical stresses produced by heating and the radial pressures due to the magnetic field produced by the current. 20 Refs.

Primary Keywords: Exploding Wires; Voltage Measurement; Current Measurement; Photographic Diagnostic; Shadowgraphy Energy Balance

COPYRIGHT: 1956 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**9800
(BREAKDOWN STUDIES; INSULATION, MATERIAL)**

(Surface Flashover; Solid)

ELECTRON AVALANCHE AND SURFACE CHARGING ON ALUMINA INSULATORS DURING PULSED HIGH-VOLTAGE STRESS

J.P. Brainerd and D. Janzen

Sandia Labs, Albuquerque, NM 87115

Journal Of Applied Physics, Vol. 45, No. 8, pp 3260-3265 (08/1974).

This paper describes a model for insulator surface charging in high-voltage ceramic vacuum diodes. The model involves electron emission from the insulator-cathode vacuum junction followed by electron avalanches on the insulator surface which leave the well positively charged. Experiments were performed to measure (i) the triple-junction (cathode-vacuum-insulator interface) emission and its relation to the initiation of the avalanche, (ii) the dynamic current in the avalanche, and (iii) the saturated surface charge resulting from the avalanche. The experimental results were interpreted by computer simulation. In terms of the model, they were found to be in close agreement with the predictions. 11 Refs.

Primary Keywords: Electron Avalanche; Pulsed High-voltage Stress; Insulator Surface Charging; Avalanche Current Termination; Cylindrical Vacuum Diodes; Secondary Electron Multiplication

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**9801
(INSULATION, MATERIAL; BREAKDOWN STUDIES)**

(Solid; Surface Flashover)

EXPERIMENTAL OBSERVATION OF SURFACE CHARGING OF HIGH-VOLTAGE INSULATORS FOR VACUUM APPARATUS

C.H. Tourrel (1), K.D. Srinivasan (2) and U.J. Meekle (3)

(1) Hydro-Quebec Institute of Research, Varennes, Quebec, Canada

(2) University of Waterloo, Waterloo, Ontario, Canada

(3) M.G. Acres, Ltd., Niagara Falls, Ontario, Canada

IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 4, pp 176-179 (12/1972).

The surface of cylindrical insulators placed in high vacuum becomes positively charged when subjected to a high-voltage stress parallel to the dielectric surface. A study is made of the variation of the surface charge density as a function of the voltage applied to insulators made of alumina ceramic, nylon, Teflon, and Plexiglas. Direct and pulsed voltages were used in the experiments. 11 Refs.

Primary Keywords: Surface Charging Of Cylindrical Insulators; High Voltage Stress; Surface Charge Density Variation; Several Insulating Materials; Spatial Resolution

COPYRIGHT: 1972 IEEE, REPRINTED WITH PERMISSION

- 9802**
(BREAKDOWN STUDIES)
(Electrodes)
EXPLOSIVE ELECTRON EMISSION FROM COPPER POINTS
V.M. Zhukov and G.N. Fursov
M.A. Bonch-Bruevich Leningrad Electrotechnical Institute Of
Communications, Leningrad, USSR
Soviet Physics-Technical Physics, Vol. 21, No. 9, pp 1112-1117
(09/1976).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1910-1917 (September
1976)
- The explosive emission of copper points is studied. In many of the experiments the emission is excited in the chamber of an electron microscope. A stage of a rapid current increase followed by saturation is a general feature of the explosive emission of point cathodes. A comparatively slow current increase is also observed during the explosion of microscopic protuberances on a large point. This behavior is attributable to the different roles played by the cathode surface in explosive emission. With a point cathode the explosive-emission current is higher than the current predicted by the three-halves law. The volumes of material transported in the explosions of Cu and W are approximately the same for similar conditions. 21 Refs.
- Primary Keywords:** Explosive Electron Emission; Copper Point Cathodes; High Electric Field; Rapid Current Growth; Current Saturation; Three-halves Law; Poor Agreement
- COPYRIGHT:** 1977 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 9804**
(BREAKDOWN STUDIES)
(Exploding Wires)
HIGH-TEMPERATURE CORES IN EXPLORING WIRES
F.D. Bennett
Army Ammunition Research and Development Command, Aberdeen Proving Ground, MD 21010
- The Physics of Fluids, Vol. 8, No. 6, pp 1106-1108 (06/1965).
- Our recent studies show that the precipitous rise in resistance during the initial expansion of the wire occurs because of a radially symmetrical, inward travelling, vaporization wave which transforms the wire to a nonconducting gas. Presence of the inward travelling vaporization wave implies longer heating of the wire interior and a temperature rise with decreasing radius. An approximate theory of the expansion is given which allows estimates to be made of the core temperatures achievable by varying the wire and circuit parameters. The experimental production of high-temperature cores is limited at present by the occurrence of voltage breakdown at the interface between wire and ambient atmosphere. 7 Refs.
- Primary Keywords:** Exploding Wires; Vaporization Wave; High-temperature Cores; Temperature Prediction; Voltage Breakdown; Theory; Core Temperature Prediction
- COPYRIGHT:** 1965 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 9806**
(SWITCHES, CLOSING; PARTICLE BEAMS, ELECTRON)
(Mechanical; Generation)
NANOSECOND PULSED ELECTRON SOURCE CONTROLLED WITH A MERCURY-WETTED SWITCH
T. Yamamoto and M. Kawanishi
Memoirs Of The Institute Of Scientific And Industrial Research, Osaka Univ., 30, pp 91-98 (01/1973).
- The authors present method of 1 ns duration E-beam generation utilizing no exotic pulse shaping or energy storage techniques. The voltage pulse is produced by discharging a coaxial line through a mercury-wetted, hydrodynamic switch. The resulting beam is a 70 keV, 240 mA, 1 ns duration E-beam. 3 Refs.
- Primary Keywords:** E-beam Generation; Mercury-wetted Switch; Electron Gun Grid; 70 keV Pulsed Electron Beam; Coaxial Cable; 240 mA Current
- COPYRIGHT:** 1973 OSAKA UNIVERSITY
- 9807**
(SWITCHES, CLOSING; PARTICLE BEAMS, ELECTRON)
(Mechanical; Generation)
NANOSECOND PULSED ELECTRON SOURCE WITH DOUBLE PULSE CONTROL
T. Yamamoto, S. Takeda and M. Kawanishi
Osaka University, Suita, Osaka, Japan
The Review Of Scientific Instruments, Vol. 45, No. 4, pp 591-592
(04/1974).
- A nanosecond pulsed electron beam is obtained by controlling the growth of an electron gun with sequential positive and negative pulses. Two mercury-wetted switches are operated to generate the double pulses. The source can deliver a 100-kV pulsed beam of the order of 1 A with 1 nsec time duration. 3 Refs.
- Primary Keywords:** E-beam Generation; Double Pulse Control; 100 keV Pulsed Electron Beam; 1 nsec Time Duration; Electron Gun Grid; Coaxial Cable; 1 Current
- COPYRIGHT:** 1974 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 9810**
(BREAKDOWN STUDIES)
(Gas, Electrical)
ON THE EARLY STAGES OF ELECTRIC SPARKS
E.O. Lawrence and F.G. Dunnington
University of California, CA
Physical Review, Vol. 13, pp 396-407 (02/1930).
- With the Kerr-cell electro-optical shutter of Abraham-Lemoine and Beaufort phenomena in the early stages of sparks between electrodes of Zn, Cd, and Mg have been studied. It was found that during 50E-8 sec after beginning of the sparks, the spark doublet lines of Zn have widths of 65A, while the corresponding lines of Cd and Mg are about 30A in width. The luminosity of the metallic vapors of Zn, Cd and Mg was observed to spread from the electrodes with speeds of 2.1E5 cm/sec, 1.5E5 cm/sec, and 1.2E5 cm/sec, respectively. Photographs of the early stages of single sparks with exposure times as short as 4E-8 sec were obtained. The snapshots showed that during these short intervals of time after beginning of a spark the discharge is confined to a filament having a cross-section at the anode of 5E-4 sq.cm. which broadens out to four times this size at the cathode. From the circuit constants and these dimensions of the discharge it was accordingly estimated that the discharge current density attained the magnitude of 1.7E13 amperes/cm. The asymmetry of the photographed images of the spark discharge when the exposure times were extended to include a complete cycle of the discharge, thereby proving the satisfactory operation of the shutter. 19 Refs.
- Primary Keywords:** Gas Breakdown; Zinc Electrodes; Cadmium Electrodes; Magnesium Electrodes; Spectroscopic Diagnostic; Streamer Propagation Velocity; Streamer Cross Section
- COPYRIGHT:** 1930 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION
- 9822**
(BREAKDOWN STUDIES)
(Surface Flashover)
THE FLASHOVER VOLTAGE OF POLYMETHYLMETHACRYLATE IN VACUUM UNDER DIRECT, ALTERNATING, AND SURGE VoltAGES OF VARIOUS FRONT DURATIONS
S. Grzybowski, E. Kuffel and J.P.C. McMath
University of Manitoba, Winnipeg, Manitoba, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-7, No. 4, pp 180-185 (12/1972).
- This paper presents results on flashover voltages across insulation surfaces and on the rate of surface deterioration in a vacuum of 1E-5 Torr under direct, alternating, and surge voltages of front duration in the range from 1-600 microseconds. The insulation material used was polymethylmethacrylate (PMMA) of cylindrical shape fitted between uniform field electrodes. The measurements were carried out on insulator specimens 25 mm in diameter and 5, 10, and 20 mm in length. 15 Refs.
- Primary Keywords:** Surface Flashover; 1E-5 Torr Vacuum; Direct, Alternating, And Surge Voltages; 1-600 Microsecond Front Duration; Organic Insulation Materials; Voltage Measurement
- COPYRIGHT:** 1972 IEEE. REPRINTED WITH PERMISSION
- 9824**
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Gas, Electrical; Electrodes)
AN EXTENSION OF THE RAMSAUER-TOWNSEND EXPERIMENT IN A XENON THYRATRON
G.A. Woolsey
University of New England, Armidale, NSW, Australia
American Journal Of Physics, Vol. 39, pp 558-560 (05/1971).
- Ramsauer-Townsend effects in xenon are observed. Differences in calculated and experimentally obtained data are shown to be a function of contact potential and electron emission energy. This series of tests improves the accuracy of earlier experiments done by Kuklich. 5 Refs.
- Primary Keywords:** Ramsauer-Townsend Experiment; Contact Potential; Electron Energy Distribution; Elastic Collision
- COPYRIGHT:** 1971 AMERICAN ASSOCIATION OF PHYSICS TEACHERS
- 9827**
(PULSE GENERATORS)
(Capacitive)
A RELIABLE 60KV FLASHLAMP TRIGGERING SYSTEM
R.E.W. Pettifer, R.G. Flavill and G.A. Robinson
The Meteorological Office, London Road, Bracknell, Berks
Journal of Physics E: Scientific Instruments, Vol. 8, pp 875-877
(05/1971).
- The unit described is an external high voltage parallel triggering system capable of operation at high repetition rates. It is controlled by a 3.5 v logic-compatible pulse and delivers a 60 k pulse to a pair of laser flashlamps. The problem of applying such pulses to the flashlamps without current leakage to the laser cavity has been dealt with in a novel way. 1 Refs.
- Primary Keywords:** Transformer Output; Thyatron Switch; High Voltage Trigger Transformer
- COPYRIGHT:** 1975 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 9866**
(SWITCHES, CLOSING)
(Gas Gaps, Electrical)
HIGH POWER SPARK GAP SWITCHES-A NUMERICAL MODEL AND EXPERIMENTAL INVESTIGATION
J.F. Driscoll (1), R.E. Heckl (1) and J. Ponsonby (2)
(1) University of Michigan, Ann Arbor, MI
(2) Naval Surface Weapons Center, Silver Spring, MD 20910
AIAA Conference On The Future Of Aerospace Power Systems, pp 1-6
(03/1977).
- This paper concentrates on optimization of spark gap parameters in the laboratory and by numerical simulation. A self-triggered, 100 pps re-ignited gap is simulated and tested while varying gas flow rate, gas type, gap pressure, current waveshape, charge transfer, and gap geometry. An optimum configuration is found and rules are presented for optimization. 13 Refs.
- Primary Keywords:** Spark Gap Optimization; Re-ignited; Recovery Time; Parameter Variation; High Average Power Transfer
- COPYRIGHT:** 1977 AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, INC.
- 9867**
(REVIEWS AND CONFERENCES; INSULATION)
(Conferences; Conferences)
IEEE 1981 CONFERENCE ON ELECTRICAL INSULATION AND DIELECTRIC PHENOMENA
(11/1981).
- This conference record contains 71 papers (13 include only abstracts) concerning basic insulation phenomena, insulation conductivity, corona, and failure modes. Other sessions pertain to charge storage and transport, dielectric breakdown, composite structures, and surface flashover; a poster session deals with polymer morphology and measurement techniques. A special one-day symposium on 'Corona and Nonspark Discharges' has been incorporated into this year's Conference. This symposium consists of invited papers that will be published in the April 1982 issue of the IEEE Transactions on Electrical Insulation. 451 Refs.
- Primary Keywords:** Electrical Insulation; Insulation Charging; Insulation Conductivity; Insulation Breakdown; Surface Flashover; Corona
- COPYRIGHT:** 1981 IEEE. REPRINTED WITH PERMISSION
- 9868**
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES; INSULATION)
(Conferences; Conferences; Conferences)
1981 IEEE 7TH INTERNATIONAL CONFERENCE ON CONDUCTION AND BREAKDOWN IN DIELECTRIC LIQUIDS
M.F. Schmidt (Ed.)
(07/1981).
- This conference record contains 90 papers relating to conduction and breakdown of liquid dielectrics. The topics of the papers presented range from fundamental studies on generation, transport and properties of the application of insulating oils in electrical equipment. Some contributions from adjacent fields which relate directly to the main theme are also included. This conference is very relevant to both liquid insulation and liquid switching. 729 Refs.
- Primary Keywords:** Liquid Breakdown; Insulation Conductivity; Charge Transport; Photoconductivity; Liquid-solid Interface; Gas Bubble Effects
- COPYRIGHT:** 1981 IEEE. REPRINTED WITH PERMISSION

9918
(REVIEWS AND CONFERENCES)
(Conferences)

5TH INTERNATIONAL CONFERENCE ON GAS DISCHARGES

(09/1978).
This conference record contains 91 papers concerning basic breakdown phenomena, circuit breaker operation, insulation systems, lightning research, spark gaps, and even laser aided chemical analysis. Many of the included papers present a fresh approach to previously investigated problems. 91 Refs.
Primary Keywords: Conference; Breakdown Mechanism; Circuit Breaker; Insulation; Spark Gap; Laser Breakdown
COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

9919
(BREAKDOWN STUDIES)
(Gas, Electrical)

EXPERIMENTAL INVESTIGATION OF STREAMER DISCHARGE DEVELOPMENT IN NEON
V.A. Davidenko, B.A. Dolgoshin and S.V. Somov
Moscow Engineering-Physics Institute, Moscow, USSR
Soviet Physics JETP, Vol. 28, No. 2, pp 227-230 (02/1969);
Trans. From: Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki 55,
435-442 (August 1968)

An image converter has been used to study the development of an electrical discharge in pure neon and in neon with a molecular impurity. We have measured the rate of development of direct and reverse streamers as a function of the electric field strength and streamer length. Possible mechanisms of photoionization of the gas are discussed. 20 Refs.

Primary Keywords: Mechanisms Of Gas Photoionization; Streamer Breakdown; Neon Gas; Discharge Velocity; Particle Track Originated Discharge
COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9920
(BREAKDOWN STUDIES)
(Surface Flashover)

INVESTIGATION OF THE PULSED BREAKDOWN MECHANISM AT THE SURFACE OF A DIELECTRIC IN A VACUUM I. UNIFORM FIELD
S.P. Bugaev, A.M. Iskol'dskii and G.A. Meavat
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Techical Physics, Vol. 12, No. 10, pp 1358-1362
(04/1968).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 1855-1860 (October 1967)
Experimental data are presented which were obtained in an investigation of luminous phenomena at, and in front of, a dielectric in pulsed breakdown along its surface in the nanosecond time range. The luminosity propagation rate along the dielectric was 2.7E7 cm/sec for a field of 137 kV/cm, and the prebreakdown current reached several amperes. A statistical study was made of the discharge delay time for pulsed breakdown. It was shown that the discharge was initiated by individual electrons and may have developed in a layer of gas adsorbed on the surface of the dielectric. 6 Refs.

Primary Keywords: Surface Flashover; Uniform Field Breakdown; Dielectric; Pulsed Breakdown; 2.7E7 cm/sec Luminosity Propagation Rate; 40 kV Voltage Pulse
COPYRIGHT: 1968 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9921
(INSULATION, MATERIAL)
(Solid)

THE APPLICATION OF WEIBULL STATISTICS TO INSULATION AGING TESTS
G.C. Stone (1) and J.F. Lawless (2)
(1) Ontario Hydro Research, Toronto, Ontario, Canada
(2) University of Waterloo, Waterloo, Ontario, Canada
IEEE Transactions On Electrical Insulation, Vol. EI-14, No. 5, pp 233-239 (10/1979).

The results of accelerated aging tests on solid electrical insulation are difficult to evaluate objectively, primarily due to the inherently large variability of the test data. This variability is often represented by the Weibull or other extreme-value probability distributions. This paper demonstrates an hypothesis test procedure which permits the objective and unambiguous evaluation of comparative dielectric tests. Two different types of computation techniques are facilitated through the use of a FORTRAN computer program. A significant difference must be established at low probabilities of failure. Analysis of typical aging tests from the literature indicate that many experiments performed to date may not be statistically significant at utilization levels. The number of tests required to achieve unambiguous significance at low probability levels may render meaningful accelerated aging tests uneconomic. 9 Refs.

Primary Keywords: Electrical Insulation Aging Tests; Weibull Statistics; Constant-stress Test; Stepped-stress Test; Correlation With Normal Aging
COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

9920
(BREAKDOWN STUDIES)
(Lightning)

LIGHTNING: VOLUME I. PHYSICS OF LIGHTNING

R.H. Golde (Ed.)
Publisher: Academic Press Inc. (01/1977).

Many researchers are now studying lightning phenomena. To assist students and researchers in this field, R. Golde has gathered the works of several authors together in one volume to present a history of the study of lightning and to give a comprehensive tutorial on the physics of lightning. Such topics as the physics of electrical breakdown, the charging process, lightning diagnosis, and lightning simulation are covered in detail. 1011 Refs.

Primary Keywords: Lightning; History; Lightning Physics; Electrical Discharge; Lightning Diagnostics; Lightning Simulation; Cloud Discharge; Ground Strike
COPYRIGHT: 1977 ACADEMIC PRESS INC.

9981
(PULSE GENERATORS)
(Trigger)

'CROWBAR' TRIGGERING METHOD FOR HIGH POWER PULSE CIRCUITS
M.A. Levine, L.S. Combas and C.C. Gallagher
AFCRL, Bedford, MA 01730
The Review Of Scientific Instruments, Vol. 32, No. 9, pp 1054-1055
(09/1961).

In dealing with high power pulse circuits required in plasma research with energies on the order of hundreds and thousands of joules being transferred in times on the order of a microsecond, the problems of timing are complicated by large voltage pickups. Of particular concern has been the development of a so-called 'crowbar' triggering pulse. A crowbar switch or circuit is designed to short out a large capacitor at the instant it is delivering maximum current and the potential difference across it is zero. This prevents the energy from being re-stored in the capacitor. An ideal method of generating a pulse to trigger a crowbar circuit and of delaying it through specific and controllable times has been developed utilizing the breakdown characteristics of a thin voltage spark gap. A spark gap with an average voltage of only 2V will break down in about 1 microsecond with faster breakdown at higher voltage. 1 Refs.

Primary Keywords: High Power Pulse Circuits; Trigger Circuits; Crowbar Circuit; Low Jitter; Noise Immunity
COPYRIGHT: 1961 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9987
(ELECTROMAGNETIC FIELD GENERATION; PULSE GENERATORS)

(Magnetic; Flux Compression)
GENERATION OF MEGA GAUSS MAGNETIC FIELDS USING A LINER COMPRESSED BY HIGH-PRESSURE GAS
E.P. Velikhov, A.A. Vedenov, A.D. Bogdanov, V.S. Golubev, E.G. Kashirskii, A.A. Kiselev, P.O. Kuberg and V.V. Chernikov
Soviet Physics-Techical Physics, Vol. 18, No. 2, pp 276-279 (08/1973);
Trans. From: Zhurnal Tekhnicheskoi Fiziki 43, 429-438 (February 1973).

The design of a device for generating pulsed megagauss fields in a large volume is described. The magnetic field is amplified by adiabatic compression in a cylindrical metal shell imploded by high-pressure gas (1-2E3 atm). The design energy in the compressed magnetic field is several megajoules and the lifetime is tens of microseconds. Unlike devices that use explosives, the present device is not destroyed. Unlike devices that use a liner, the problem of storing and switching very large amounts of electromagnetic energy does not arise. 18 Refs.

Primary Keywords: Flux Compression; Megagauss Magnetic Field Generation; High Pressure Gas Adiabatic Compression; Efficient Energy Transfer
COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

9983
(SWITCHES, CLOSING)
(Gas Gap, Electrical)
(LOW-INDUCTANCE 100 KV SWITCH (SPARK GAP) FOR STARTING, DIVERTING AND CLAMPING CAPACITOR DISCHARGES

A.E. Bishop and B.D. Edmonds
Culham Lab, Abingdon, Oxfordshire, UK
Proceedings Of The IEE, Vol. 113, No. 9, pp 1549-1556 (09/1966).

The authors describe a field distortion switch designed to operate reliably to 100 kV voltage. Operating in a cascade mode, the switch can be triggered with such reliability to allow operation as a crowbar switch either at zero current or at maximum current. The design and testing of the switch is considered in some detail. 4 Refs.

Primary Keywords: Spark Gap; Clamping Capacitor Discharges; Field-distortion Switch; 25 ns Minimum Breakdown Time; Divert-switch; Clamp-switch; >200 kA Currents; 20-100 kV Voltage Range
COPYRIGHT: 1966 IEE

9997
(SWITCHES, OPENING)
(Mechanical)

SWITCHING IN VACUUM: A REVIEW

A. Selzer
Cutler-Hammer Inc, Deer Park, NY
IEEE Spectrum, pp 26-36 (06/1971).

The growing use of vacuum interruption devices by the power and control industries in the past decade has introduced these mechanisms to many people to whom the area of vacuum switching is somewhat new. It is felt that a review of vacuum switching from a historical and technological standpoint will facilitate a more general understanding of this important subject. 24 Refs.

Primary Keywords: Vacuum Interruption Devices; Vacuum Technology; Electric Discharge; Historical Review
COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

10002
(BREAKDOWN STUDIES)
(Liquid, Electrical)

VARIATIONS IN THE RESISTANCE OF SPARK GAPS IN WATER UNDER THE EFFECT OF HIGH PULSE VOLTAGE

I.I. Kalyatskiy, G.S. Korshunov and G.A. Kiselev
Academy of Sciences of the USSR, Tomsk, USSR
Applied Electrical Phenomena, No. 6, pp 28-31 (12/1971).

Trans. From: Elektronnaya Obrabotka Materialov 6, 32-36 (1971).
The authors study the resistance of a water spark in the context of electrical discharge machining. The resistance of the spark is measured as a function of pulse shape, geometry, gap length, and initial water resistivity. A large prebreakdown current is found. 3 Refs.

Primary Keywords: Liquid Spark Gap; Spark Gap Resistance; High Pulse Voltage; Electric Field Configuration; Spark Gap Length; Initial Voltage Pulse Parameters
COPYRIGHT: 1971 SCIENTIFIC INFORMATION CONSULTANTS LTD.

10003
(BREAKDOWN STUDIES)
(Gas, Electrical)

GAS-HEATING EFFECT ON PLASMA RESISTIVITY

J.E. Creden and S. Schneider
ECOM, Fort Monmouth, NJ 07703

Journal Of Applied Physics, Vol. 40, No. 13, pp 5212-5216 (12/1969).
Measurements of hydrogen-plasma resistivity were made under conditions where the dominant loss mechanism was electron-neutral collisions. Three-inch-diameter tubes with electrode spacings ranging from 2-22 in. were used. Measurements were made at 15 and 22 kA, 5 microseconds pulse duration, and pressures of 0.5, 1.0, and 5.0 Torr. Electron density and temperature measurements were obtained from Stark broadening and ionization-ratio techniques. The predicted resistivity was calculated from electron-proton and electron-neutral collisions and compared with the absolute resistivity calculated from the voltage-current measurements. The gas-temperature rise was determined from the resistance difference obtained from the two calculations. The energy expended in gas heating was determined to be 2.4x4.2% of the input energy. 10 Refs.
Primary Keywords: Hydrogen Discharge; Plasma Resistivity; Neutral Gas Heating; Electron-neutral Collision; Energy Balance
COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10004
(BREAKDOWN STUDIES)
(Lightning)

LIGHTNING: VOLUME II, LIGHTNING PROTECTION

R.H. Gold (Ed.)
Published: Academic Press Inc. Ltd. (01/1977).

Lightning protection is a necessary part of ensuring safety of personnel, equipment, and structures in all parts of the world. Threat-level determination, lightning detection, and lightning stroke diversion effectiveness are all addressed in this book. The book begins with a thorough discussion of the development of lightning early warning systems and proceeds to discuss the effects on humans, flora, electronic equipment, structures, and aircraft. A chapter is included on grounding. 510 Refs.
Primary Keywords: Lightning Protection; Lightning Effects; Lightning Prediction; Lightning Diversion; Lightning Prevention
COPYRIGHT: 1977 ACADEMIC PRESS INC.

10005
(POWER CONDITIONING)
(Pulse Transformers)

A PULSE TRANSFORMER FOR LARGE WIRE SPARK CHAMBERS

L. Andersson, E. Rademacher and C. Rubbia
CERN, Geneva, Switzerland

Nuclear Instruments And Methods, Vol. 75, No. 2, pp 341-343 (11/1969). It is remarked that by interposing a stepdown transformer between the high-voltage generator and wire spark chambers, the pulsing of the larger size chambers can be eased considerably. A simple transformer made solely of coaxial cables has been built and tested. 5 Refs.

Primary Keywords: Stacked Line Transformer; Large Wire Spark Chambers; Coaxial Cable Pulse Transformer; 2.0 Ohm Chamber Impedance; 5.0 kV Peak Pulse Voltage; 1.25E7 W Peak Power
COPYRIGHT: 1969 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

10007
(PULSE GENERATORS)
(Stripline)

A SIMPLE STRIPLINE PULSER FOR SPARK CHAMBERS

M.R. Mouilla, P.E. Denner and A.G. Sheldon
Westfield College, London, UK

Nuclear Instruments And Methods, Vol. 79, No. 2, pp 325-328 (03/1970). A spark chamber pulser has been constructed using a stripline as both feeder cable and storage capacitor. The inductance of the unit is thereby minimized in a simple and inexpensive way and a pulse rise time of 10 ns into a 1000 pF load is achieved. 0 Refs.

Primary Keywords: Spark Chamber Pulser; 10 ns Pulse Rise Time; 1000 pF Load; Low Inductance Layout; Stripline Energy Store
COPYRIGHT: 1970 NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

10009
(POWER CONDITIONING)
(Pulse Inverters)

A TRANSMISSION-LINE PULSE INVERTER

R.W. Roehle
Naval Research Lab., Washington, DC 20375
The Review Of Scientific Instruments, Vol. 23, No. 6, pp 298-300 (06/1952).

The polarity of fast rise-time pulses can be inverted with a minimum of distortion by means of a transmission-line network. The features in the design of a typical pulse inverter for obtaining push-pull cathode-ray-tube deflection voltages from single-ended signals are presented. The normalized design graphs are a considerable aid in the calculation of pulse-inverter characteristics. 0 Refs.
Primary Keywords: Pulse Polarity Inverter; Fast Rise-time Pulses; Transmission-line Network; Polarity Switching; Shield Impedance; Design Considerations
COPYRIGHT: 1952 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10013
(POWER CONDITIONING; POWER CONDITIONING)
(Pulse Transformers; Materials; Saturable Reactors, Materials)
EDDY-CURRENT-LIMITED GROWTH OF FERROMAGNETIC DOMAINS ON THE SURFACE OF SQUARE-LOOP ALLOY TAPE

J.E.L. Bishop
University of Sheffield, Sheffield, UK
Journal Of Physics D: Applied Physics, Vol. 9, No. 14, pp 2095-2110 (10/1976).

The expansion of small, initially hemicylindrical domains on the surface of square-loop alloy tapes has been simulated numerically under conditions of (i) constant drive field $H_{\text{sub}} A/\text{c}$, and (ii) constant flux-reversal rate $\dot{\phi}$. The calculations treat each element of domain wall as being individually in dynamic equilibrium under the pressure of the applied and local eddy-current magnetic fields and the domain wall surface tension. The 'coercive field' $H_{\text{sub}} c$ is also ignored as the model is intended to apply to situations in which the applied field greatly exceeds the coercive field. By expressing the equations of motion in reduced units, it has been possible to condense all constant $H_{\text{sub}} A/\text{c}$ growth sequences onto a single sequence and similarly all constant $\dot{\phi}$ sequences onto another. When expressed in compatible units these two reduced sequences are found to be closely equivalent. This demonstrates that growth at any instant depends mainly on the value of a single growth parameter and is only very weakly influenced by the history of the growth. The changing shape of the domain wall during the motion has been represented to high accuracy by the use of up to 92 symmetric polarized segments. At a fixed flux-reversal rates per domain $\dot{\phi}$, the field required to drive the expansion is shown to be proportional to $\dot{\phi}^{0.618}/\text{c}^2$ and to the domain cross-sectional area to the power -0.191. 19 Refs.
Primary Keywords: Domain Expansion; Constant Drive Field; Constant Flux-reversal Rate; Eddy-current Magnetic Fields; Ferromagnetic Alloy Tape Cores

COPYRIGHT: 1976 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10018
(BREAKDOWN STUDIES)
(Gas, Electrical)

FORMATIVETIME LAGS IN THE ELECTRICAL BREAKDOWN OF GASES

J. Dutton, C. Haydon and F. Lloyd-Jones
University College, Swansea, Singleton Park, Swansea, Wales
British Journal Of Applied Physics, Vol. 4, pp 170-175 (06/1953).

The time rate of growth of ionization currents in a gas in a uniform electric field greater than that corresponding to the static sparking potential is investigated theoretically. This theoretical analysis is then applied to the breakdown of a gas at high values of the parameter pd . It is shown that the same primary and secondary ionization processes which lead to a growth of pre-breakdown currents in agreement with experiment, and to the calculation of static sparking potentials in agreement with those measured, also lead to a rapid decrease of the formative time lag with increasing overvoltage. The introduction of some other quite different process to account for the short formative time lag is unnecessary. The present theoretical investigation, together with previous experimental and theoretical studies, therefore lay the basis of a comprehensive view of the electrical breakdown of gases, covering a wide range of parameters. Curves showing the dependence of the formative time lag on overvoltage, calculated by means of the above analysis, are given; these curves may be used to elucidate the various secondary ionization processes operative in the breakdown mechanism. 25 Refs.
Primary Keywords: Ionization Current Growth; Uniform Electric Field; Static Sparking Potential; Formative Time Lag Decrease
COPYRIGHT: 1953 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10019
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)

FRINGING FIELDS IN A PARALLEL-PLATE CAPACITOR

A. Haini and M. Green
University of Washington, Seattle, WA
American Journal Of Physics, Vol. 45, No. 9, pp 877-879 (09/1977).

The fringing fields in capacitors are studied both experimentally and theoretically to determine the correction to the basic capacitance formula for a circular parallel-plate capacitor. The capacitance is varied to allow comparison at several values of capacitance. A constant offset in capacitance is also found but is believed to be due to stray capacitance in the apparatus. 2 Refs.
Primary Keywords: Capacitor Fringing Field; Idealized Model Corrections; Circular Parallel-plate Capacitor
COPYRIGHT: 1977 AMERICAN ASSOCIATION OF PHYSICS TEACHERS

10028
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

PLASMA PROPERTIES OF A METAL VACUUM ARC. I

V.M. Luneev, V.D. Ovcharenko and V.M. Khoroshikh
Physicotechnical Institute, Academy of Sciences of the Ukrainian SSR,
Kharkov, USSR
Soviet Physics-Technical Physics, Vol. 22, No. 7, pp 855-861 (07/1977). Trans. From: Zhurnal Tekhnicheskoi Fiziki 47, 1486-1490 (July 1977)

Certain characteristics of the plasma of a metal (Mo) vacuum arc are measured. The measurements are carried out with single and double electrostatic probes and a multigrid analyzer. The plasma density, the spatial distribution of the plasma density, the electron and ion temperatures, etc., are determined. The fluxes of ions and neutrals are estimated. It is found that a metal vacuum arc generates plasma streams with a directed ion energy of 20-30 eV. The plasma density is $10^9 - 10^{11}$ per cu.cm., and the electron temperature is approximately 3 eV. 9 Refs.
Primary Keywords: Metal Vacuum Arc; Plasma Properties; Electrostatic Probes; Multigrid Analyzer; $10^9 - 10^{11}$ per cu.cm.; Plasma Density; 3 eV Electron Temperature; Spatial Distribution; Molybdenum Electrodes
COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10029
(POWER CONDITIONING)

(Pulse Transformers; Materials)

POTENTIAL OF AMORPHOUS ALLOYS FOR APPLICATION IN MAGNETIC DEVICES
F.E. Luborsky, J.J. Becker, P.G. Frischmann and L.A. Johnson
General Electric Co., Schenectady, NY 12301

Journal Of Applied Physics, Vol. 49, No. 3, pp 1769-1774 (03/1978).

Amorphous alloys have potential applications in all types of magnetic devices, in both the electronic and power areas of application. For electronic devices, the properties are comparable to those of commercial alloys, and the materials offer potentially much lower cost. In power applications such as transformers, losses are far lower than in materials used at present. This results in a potential favorable trade off between first cost and a substantial energy savings throughout the life of the device. Although power applications have not been emphasized up to now, they appear to hold great promise, especially as wider amorphous tapes become available. 39 Refs.

Primary Keywords: Amorphous Alloys; Magnetic Devices; Market Structure; Fabricability; Annealing; Cost

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10030
(BREAKDOWN STUDIES)
(Exploding Wires)**PULSED LASER STEREOPHOTOGRAPHY OF MINIATURE EXPLDING FOILS**
D.L. Pashley
Mitsubishi Research Corp., Mexia, OH 45342

SPIE, Vol. 97, pp 184-188 (01/1978).

The results of a photographic study of exploding foils are presented. A pulsed ruby laser is used to illuminate the foil to "freeze" the explosion and to allow filtering of the plasma red region. The image is recorded on a stereocamera. The analysis of the photographs is described, and a short discussion of results is presented. 4 Refs.

Primary Keywords: Miniature Exploding Foils; Pulsed-laser Stereophotography; Optically Intense Plasma; Framing Camera; Stereo Imaging

COPYRIGHT: 1978 SOCIETY OF PHOTO-D-OPTICAL INSTRUMENTATION ENGINEERS

10031
(ELECTROMAGNETIC COMPATIBILITY)
(Grounding And Shielding)

REDUCING ELECTRICAL INTERFERENCE

E.S. Ida
DuPont Co., Wilmington, DE 19898

Control Engineering, Vol. 9, No. 2, pp 107-111 (02/1962).

Grounding and shielding of remote sensors is the subject of this paper. Several definitions are presented and corrective measures for several grounding and shielding problems are considered. The author stresses that each problem is unique and should be considered so. 0 Refs.

Primary Keywords: Electrical Interference; Cleaner Control Signals; Shielding; Ground Loops; Electrostatic Induction; Balanced Line

COPYRIGHT: 1962 McGRAW HILL PUBLISHING CO.

10035
(DIAGNOSTICS AND INSTRUMENTATION)
(Specifications)

SPECIFYING POWER CONDITIONING EQUIPMENT

R.L. Anderson
Maxwell Labs Inc., San Diego, CA 92123

Electrical Systems Design, pp 10-15 (03/1975).

This paper should be very helpful to those who must specify a power conditioning system, whether it is to be constructed in-house or contracted. The process of specifying a system is considered in seven steps with important points considered at each step. Some points of prime concern when specifying a system to a contractor are also discussed. 0 Refs.

Primary Keywords: Power Conditioning System Specification;

Specification Determination

COPYRIGHT: 1975 MILTON S. KIVER PUBLICATIONS INC.

10036
(ENERGY STORAGE, CAPACITIVE)
(Capacitors)

THE BEHAVIOR OF POLYESTER FILM ENERGY STORAGE CAPACITORS

B.R. Hayworth
Maxwell Labs Inc., San Diego, CA 92123

IEEE Transactions On Electrical Insulation, Vol. EI-3, No. 2, pp 47-49 (05/1968).

An other mental study of the electrical properties of energy storage capacitors utilizing Mylar polyester films has shown how the weight and volume of such capacitors could be reduced while improving reliability and energy density. Test data relate the lifetime of a capacitor to its operating voltage, discharge frequency, and temperature. The effect on life of percent current reversal and dielectric film thickness is also demonstrated. The results should enable capacitor designers to tailor products to specific applications, thereby achieving optimum performance. 0 Refs.

Primary Keywords: Energy Storage Capacitors; Mylar Polyester Films;

Percentage Current Reversal; Dielectric Film Thickness; Energy Density

COPYRIGHT: 1968 IEEE. REPRINTED WITH PERMISSION

10037
(BREAKDOWN STUDIES; INSULATION, VACUUM)
(Vacuum, Electrical)

THE INSULATION OF HIGH VOLTAGES IN VACUUM

J.G. Trump and R.J. Van De Graaff

Massachusetts Institute of Technology, Cambridge, MA

Journal Of Applied Physics, Vol. 18, No. 3, pp 327-332 (03/1947).

Breakdown studies have been made between electrodes in high vacuum at constant voltages from 50 to 700 kV. These further demonstrate the inadequacy of the field emission theory to account generally for high voltage breakdown in vacuum. Experiments are described which investigate some of the total voltage breakdown mechanisms, including positive ion impact, electron impact, electron emission by positive ion impact, and by photons. In the DC case these processes contribute to a steady interchange of charged particles between cathode and anode which increases with voltage until breakdown occurs. At higher breakdown voltages the cathode gradient is diminished far below the value for field emission. Measurements of electron emission by electrons with energies up to 300 eV for tungsten, steel, aluminum, and graphite are reported. The possibilities of predicting and of improving the insulating strength of electrode gaps in high vacuum by the study of the coefficients of the electrode materials are discussed. 13 Refs.

Primary Keywords: Vacuum Insulations; 50 To 70 KV; Constant Voltages; High Voltage Breakdown; Insulating Strength; Electrical Materials; Field Emission

COPYRIGHT: 1947 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10039
(BREAKDOWN STUDIES)

(Gas, Electrical)

TIME LAGS AND THE BREAKDOWN AND CORONA CHARACTERISTICS IN SULPHUR HEXAFLUORIDE

E. Ruffel and R.D. Redman

University of Manchester, Manchester, UK

Proceedings Of The IEE, Vol. 113, No. 11, pp 1863-1872 (11/1966). Uniform field breakdown of SF₆/air with variation of several gap parameters is the subject of this paper. DC voltages are utilized with superimposed square pulse voltages to overvolt air and SF₆/air gaps. Breakdown delay is measured as a function of gap spacing, pressure, irradiation, and breakdown history. SF₆/air is found to exhibit large litter for low overvoltage. 20 Refs.

Primary Keywords: Sulphur Hexafluoride Breakdown; Variable Gas Pressure; Electrode Conditioning; Time Lag; Breakdown Characteristics; Corona Current

COPYRIGHT: 1966 IEE

10040

(PCHEP TRANSMISSIONS)

(Transmission Lines)

USE OF RADIAL TRANSMISSION LINES IN PULSED ACCELERATORS

V.I. Kazachev and I.V. Korobukov

Soviet Physics-Technical Physics, Vol. 21, No. 7, pp 841-844 (07/1976).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 46, 1477-1483 (July 1976). Radial transmission lines with various electrode shapes are studied. An electrode configuration with a double-radial line can produce a voltage pulse in which the flat top drops by less than 10%. A multiple-gap pulsed accelerator can be constructed with double radial transmission lines of this kind. 8 Refs.

Primary Keywords: Radial Transmission Lines; Various Electrode Shapes; Multiple-gaps Pulsed Accelerator; Radial Transmission Lines; Pulsed Voltage Pulse Transfer

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10041
(BREAKDOWN STUDIES)

(Exploding Wires)

VISIBLE AND NEAR-UV EMISSION IN THE ELECTRICAL EXPLOSION OF A THIN METAL FOIL

V.I. Baikov, V.V. Blagoveshchenskiy, B.G. Komkov and Yu.T. Masurenko

Soviet Physics-Technical Physics, Vol. 20, No. 5, pp 788-790 (05/1975).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 1128-1132 (May 1975). In a study of the electrical and optical characteristics of the electrical explosion of a thin metal foil in air it has been found that the light emission obtained at energy inputs of up to 20 kJ/sq.cm. of foil have a brightness temperature of up to 35,000 Deg.K., a length of 4-6 microseconds, and a short rise time. It is found that approximately 35% of the electrical energy is converted into radiation. 10 Refs.

Primary Keywords: Exploding Foil; Visible And Near-UV Emission; 35,000 Deg.K. Brightness Temperature; 4-6 Microsecond Light Pulse Length; 35% Electrical Energy Conversion Rate; Radiation Characteristics; High-Current Pulsed Discharge

COPYRIGHT: 1976 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10043
(BREAKDOWN STUDIES)

(Exploding Wires)

KERR CELL STUDIES OF EXPLDING WIRES IN VACUUM

S. Kubera, S.K. Hordel and B. Stenerback

Institute Of Physics, University of Uppsala, Uppsala, Sweden
Journal Of The Society Of Motion Picture Television Engineers, Vol. 82, No. 3, pp 187 (03/1973).

The authors compare the optical emission of tungsten, molybdenum, and nickel wires using a single-frame Kerr-cell camera. Tungsten and molybdenum wires are chosen specifically for their high melting points while nickel is used for comparison. A model is presented. The explosion is found not to be dependent on radial electric field. 4 Refs.

Primary Keywords: Exploding Wires; Kerr-cell Camera Shutter; Tungsten Wire; Molybdenum Wire; Nickel Wire; Radial E-field Independence

COPYRIGHT: 1973 THE SOCIETY OF MOTION PICTURE TELEVISION ENGINEERS

10048
(PULSE GENERATORS)

(Systems)

HAND-SECOND CURRENT PULSE GENERATOR FOR SUPPLYING SEMICONDUCTOR LASERS

B.M. Koval'chuk

Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, No. 4, pp 884-887 (08/1968).

Trans. From: Priroda I Tekhnika Experimenta 4, 116-119 (July-August 1968).

A generator of nanosecond current pulses for powering semiconductor lasers is described. Current pulses with an amplitude of 1 KA and edge of 0.5 nsec at a repetition frequency of up to 1E4 Hz are obtained. Primary Keywords: Pulse Generators; Semiconductor Lasers; 1 KA Amplitude; 0.4 nsec Pulse Edge; 1E4 Repetition Frequency; 10-30 nsec Duration; 200 W Total Required Power; Reprinted

COPYRIGHT: 1968 PLenum Press. REPRINTED WITH PERMISSION

10049
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Gas, Radiation; Gas Gaps, Optical)

VOLT-AMPERE CHARACTERISTIC AND TRANSITION CURRENT OF A GAS GAP WHEN ACTED UPON BY PULSED IONIZING RADIATION

V.A. Argunov, V.V. Zakharev, G.F. Isakov and E.V. Chekhunov

Moscow, USSR
Journal Of Applied Mechanics And Technical Physics, Vol. 18, No. 2, pp 154-156 (04/1977).

Trans. From: Zhurnal Prikladnoi Mekhaniki i Tekhnicheskii Fiziki 2, 14-18 (March-April 1977).

The problem of the reduction of the breakdown voltage of a gas gap when it is acted upon by a high-power ionizing pulse is considered. The prebreakdown transition currents are calculated for argon and air in the case of a wide gap (the distance between the electrodes is 1 cm). The problem of the form of the volt-ampere characteristic in the high-current range (the "glow" discharge mode) was not considered. The purpose of the present paper is to calculate the volt-ampere characteristics of a narrow gas gap ($d=2-2$ cm) in both the high- and low-current regions (the range of currents limited by space charge). 8 Refs.

Primary Keywords: Gas Breakdown; Ionizing Radiation; Radiation Effect On Breakdown; Theory; Voltage Calculation; Current Calculation

COPYRIGHT: 1977 PLenum Press. REPRINTED WITH PERMISSION

- 10050**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
- BREAKDOWN OF VACUUM SPARK GAPS**
- R. C. Mason
Westinghouse Electric Corp., Pittsburgh, PA
Physical Review, Vol. 52, No. 2, pp 126-127 (07/1957).
- Experiments with vacuum spark gaps show that the critical cathode field required for breakdown is not reduced by considerable thermionic emission from the cathode. It is concluded that positive ion emission from the anode under electron bombardment, which apparently enters at higher voltages, is not a factor up to 50 kV. 7 Refs.
- Primary Keywords:** Vacuum Breakdown; Critical Cathode Field; Thermionic Emission; Anode Ion Emission; Gas Evolution; Metal Vaporization
- COPYRIGHT:** 1957 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION
- 10055**
(BREAKDOWN STUDIES; BREAKDOWN STUDIES)
(Vacuum, Electrical; Electrical)
- ELECTRODE PROTRUSIONS PRODUCED BY ELECTRON BEAM BOMBARDMENT AND THEIR ROLE IN VACUUM BREAKDOWN**
- A. Maitland (1) and R. Healey (2)
(1) International Research and Development Co Ltd, Newcastle-upon-Tyne, UK
(2) C.R. Parsons & Co Ltd, Newcastle-upon-Tyne, UK
British Journal of Applied Physics, Vol. 16, pp 1591-1592 (10/1965).
It was found that bombardment of copper samples by an electron beam in a vacuum chamber produced the formation of minute metallic protrusions on the copper surface. The possible bearing of such a process on the mechanism of electrical breakdown in high vacuum is considered. 9 Refs.
- Primary Keywords:** Vacuum Breakdown; Copper Electrodes; E-beam Bombardment; Microprotrusion Generation
- COPYRIGHT:** 1965 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 10073**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
- VACUUM SPARK EROSION AT CATHODIC INCLUSIONS**
- J.T. Maskrey
Atomic Energy Research Establishment, Harwell, Berkshire, UK
British Journal of Applied Physics, Vol. 16, pp 1583-1584 (10/1965).
Erosion found at inclusion sites in copper and stainless-steel cathodes after vacuum breakdown suggests that the vacuum arc initiation process may be closely related to that in unipolar arcs, where similar cathode damage occurs. 10 Refs.
- Primary Keywords:** Vacuum Breakdown; Electrode Erosion; Erosion Site Determination; Cathode Inclusions; Copper Cathode; Stainless Steel Cathode
- COPYRIGHT:** 1965 THE INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 10074**
(PARTICLE BEAMS, ELECTRON)
(Generation)
- EXPLOSIVE EMISSION ELECTRONS FROM METALLIC NEEDLES**
- G.A. Mesyats and D.I. Proshko Ushki
Institute of Atmospheric Optical Academy of Sciences of the USSR, Moscow, USSR
JETP Letters, Vol. 13, No. 1, pp 4-6 (01/1971).
Transl. from ZHETF Pis'ma v Redaktsiyu 13, 7-10 (January 1971).
Metallic needles are widely used as sources of electron current pulses of 1E3-1E5 A. It is customarily assumed that the emission of the electrons from the needles at such currents is due entirely to field emission. Our investigations have shown that the appearance of large electron currents is preceded by an electric explosion of the tip of the needle and the formation of a plasma as a result of resistive heating by the field emission current. 5 Refs.
- Primary Keywords:** Explosive Emission Electrons; Metallic Needles; 1E3-1E5 A Electron Current Pulses; Plasma Formation; Cathode Flares; 10-500 KV Voltage Amplitude
- COPYRIGHT:** 1971 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION
- 10106**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
- THE RELATION BETWEEN ELECTRIC FIELD EMISSION AND CONTACT ELECTROMOTIVE FORCE FOR LIQUID MERCURY**
- D.H. Moore
University of Virginia, VA
Physical Review, Vol. 50, No. 4, pp 344-347 (08/1936).
The relation between contact EMF and the impulsive potential necessary to initiate a vacuum spark has been studied for liquid mercury cathode. The magnitude and time of application of the impulsive potential were determined by a cathode-ray oscillograph so that possible distortion of the mercury surface produced by the electric field could be evaluated. The value of the mercury no definite relation could be found. However, for carefully distilled mercury the relation between the work function and breakdown field was in quantitative but not in quantitative agreement with theory. 11 Refs.
- Primary Keywords:** Vacuum Breakdown; Mercury Cathode; Surface Distortion; Breakdown Voltage; Impulse Voltage; Field Emission
- COPYRIGHT:** 1936 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION
- 10107**
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
- THE RELATION BETWEEN THE ELECTRON FIELD EMISSION AND THE WORK FUNCTION OF LIQUID MERCURY**
- L.P. Quarles
University of Virginia, VA
Physical Review, Vol. 48, No. 3, pp 250-264 (08/1935).
The variation in the field necessary to initiate a vacuum discharge between a mercury cathode and a molybdenum anode and the accompanying variation in the work function of the cathode have been measured. The work function variations were obtained from measurements of the contact potential between the mercury and a platinum filament. The fields were applied by an impulse circuit, the time constant of the voltage pulse being very short in order to prevent distortion of the mercury. The final results show a variation of the field with work function which while in the same direction is more pronounced than that forecast by the Fowler-Nordheim theory. For a change of work function of one volt the field required to initiate the discharge varied from 115 kV/cm to 575 kV/cm. A Paris Primary Keywords: Vacuum Breakdown; Mercury Cathode; Molybdenum Anode; Field Emission; Cathode Work Function
- COPYRIGHT:** 1935 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION
- 10112**
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)
(Conferences: Exploding Wires)
- EXPLODING WIRES: VOLUME III**
- W.G. Chase (Ed.), (1) and J.W. Moore (Ed.), (2)
(1) AFCRL, Bedford, MA 01730
(2) Lowell Technological Institute Research Foundation, Lowell, MA
Published: Plenum Press, New York (01/1964).
Exploding Wires, Volume 3 contains the proceedings of the Third Conference on the Exploding Wire Phenomenon as its predecessors contained the proceedings of the earlier conferences. There are papers on theory, on shock waves, and on apparatus and instrumentation, recording the advances in the state of the art in each of these fields. A group of three papers on exploding bridge wires dominates the section on uses, but there is also a paper on chemical synthesis by E.W.L. Exploding foils' entry into the R&D stage is described in a paper on a pulsed satellite accelerator. 196 Refs.
- Primary Keywords:** Exploding Wires; Theory; Shock Wave; Instrumentation; Bridge Wire; Opening Switch
- COPYRIGHT:** 1964 PLENUM PRESS. REPRINTED WITH PERMISSION
- 10119**
(DIAGNOSTICS AND INSTRUMENTATION)
(P-feld)
- METHODS OF MEASURING VARYING AND PULSED MAGNETIC FIELDS (REVIEW)**
- N.S. Roberts
Institute of Nuclear Physics, Academy of Sciences of the USSR, Novosibirsk, USSR
Instruments and Experimental Techniques, No. 4, pp 963-972 (08/1970).
From: From: Primary: Tekhnika Experimenta 4, 7-16 (July-August 1970).
Methods of measuring varying and pulsed magnetic fields are reviewed systematically. Particular attention is given to methods of measuring fields up to nonresonant frequencies. DC, SQUID, methods are discussed; inductive methods, the Faraday method; Methods using the Hall, Faraday, and Zeeman effects; and the magnetoresistive method. 91 Refs.
- Primary Keywords:** Magnetic Field Measurement; Pulsed Field; Comparison of Several Methods; Ferroprobe; Hall Effects; Faraday Effect; Zeeman Effect; Magnetoresistive Method
- COPYRIGHT:** 1970 PLENUM PRESS. REPRINTED WITH PERMISSION
- 10123**
(BREAKDOWN STUDIES)
(Solid, Electrical)
- IPC-INTERACTION AND GAS-EVOLUTION CHARACTERISTICS OF COMMON POLYMERIC MATERIALS**
- P.F. Hettner
McGraw-Hill Inc., Franklin, WI
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1689-1696 (06/1982).
An extensive study was undertaken to determine the arc-interruption and gas-evolution characteristics of a number of common polymeric materials. The materials were selected to determine their potential use in electrical apparatus. The test results show the composition and distribution of arc-quenching gases produced during interruptions and the importance of volume cooling with gas on energy dissipation. A scheme is proposed for the arc-induced decomposition of a polymer and the predominant chemical reactions that account for the formation of the gas species observed is theoretically discussed. 6 Refs.
- Primary Keywords:** Polymeric Material; Breakdown; Evolved Gas Corporation; Theory
- COPYRIGHT:** 1982 IEEE. REPRINTED WITH PERMISSION
- 10124**
(BREAKDOWN STUDIES)
(Gas, Electrical)
- SF₆-SUB 67 GAS CIRCUIT BREAKER**
- Y. Itoh, Y. Muraki, A. Ohno and T. Iwatsumi
Mitsubishi Electric Corp., Amagasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 12-9, 510 (06/1982).
The SF₆ parameters of sub 67 gas circuit breakers were classified based on the thermogas dynamic simulation of arc quenching in SF₆. Using the pressure generation by the arc itself, the results of the simulation revealed that the puffer breaker with high interrupting capacity can be designed with much less cylinder volume and much less driving power compared with the breaker designed by the conventional way of increasing the mechanical load of the puffer. The SF₆ interrupting capacity of a compact puffer breaker with an interrupting capacity of 53 kA at 7.2 KV was developed based on the SF₆ sub 67. 2 Refs.
- Primary Keywords:** SF₆; Breakdown; Gas Recovery; Numerical Simulation; Geometry Considerations; Puffer Circuit Breaker
- COPYRIGHT:** 1982 IEEE. REPRINTED WITH PERMISSION
- 10125**
(BREAKDOWN STUDIES)
(Gas, Electrical)
- EXPERIMENTAL AND THEORETICAL STUDY OF A DC ARC IN A CONSTANT DIAMETER NOZZLE FLOW**
- H. Nagatomo
General Electric Co., Schenectady, NY 12301
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1578-1587 (06/1982).
The cold air flow field for a 1.27 cm constant diameter nozzle was determined for subsonic and transonic flow velocities. In addition, DC arc voltage, current and diameter measurements were made for an arc gap of 5.52 cm and a current of approximately 100 A. Arc voltage increased rapidly as the flow velocity increased from zero to sonic velocity. Using the heat flux model with constant arc temperature and the energy integral for the convective cooling, analytical requirements were derived for the arc radius, electric field strength, arc voltage, resistance, and power as functions of the cold flow properties, current, and axial distance. Calculated arc voltages, resistances, and powers compare favorably with measured values. 24 Refs.
- Primary Keywords:** DC Arc; Flowing Gas; Subsonic Flow; Transonic Flow; Current Measurement; Voltage Measurement; Arc Diameter; Theory; Experiment
- COPYRIGHT:** 1982 IEEE. REPRINTED WITH PERMISSION

10126

(BREAKDOWN STUDIES)

(Gas; Recovery)

FACTORS INFLUENCING THE INTERRUPTING ABILITY OF SF₆/PUFFER BREAKER AND DEVELOPMENT OF 300KV-50KA ONE-BREAK CIRCUIT BREAKER
S. Yanabu, H. Mizoguchi, A. Kobayashi, Y. Ozaki and Y. Murakami
Toshiba Corp., Kawasaki, Japan
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1511-1518 (06/1982)

The factors to be considered at the design stage of the extinction chamber of a SF₆/puffer gas circuit breaker (GCB) have been examined numerically and analytically. It has been shown that an extinction chamber which satisfies both Short Line Fault (SLF) and Breaker Terminal Fault (BTF) conditions simultaneously is not economical and capacitor parallel to it should be used. On the basis of the above analysis, a 300KV-50KA one-break chamber has been developed successfully. 16 Refs.

Primary Keywords: SF₆/sub 6/ Breakdown; Gas Recovery; Puffer Circuit Breaker; Performance Test; Theory; Experiment

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

10127

(INSULATION, MATERIAL)

(Solid)

PHYSICAL MODEL OF ELECTRIC AGING AND BREAKDOWN OF EXTRUDED POLYMERIC INSULATED POWER CABLES

C. Baldwin (1), T. Garrity (2), M. Sosikowski (1); R. Eaton (2) and C. Katz (1)
(1) Cable Technology Labs., Inc., New Brunswick, NJ
(2) U.S. Dept. Of Energy, Washington, DC
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1379-1380 (06/1982)

This paper postulates a physical model of electric aging and breakdown of polymeric insulated high voltage cables and substantiates this model with results of tests. In accordance with the model, scission of molecular chains and formation of craters at discharging voids are responsible for the electric aging and voltage breakdown of polymeric insulation. A method for the rapid determination of threshold voltage by means of voltage breakdown tests has been developed. These tests indicate that at voltages above the threshold voltage the breakdown voltage decreases with an increase of time of voltage application. At voltages below the threshold voltage, insulation breakdown is not expected. 33 Refs.

Primary Keywords: Polymeric Insulation; Insulation Aging; Insulation Breakdown; Voltage; Threshold Voltage

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

10128

(BREAKDOWN STUDIES)

(Gas; Electrical)

RANDOM PREBREAKDOWN DISCHARGES IN SF₆/SUB 6/- A POSSIBLE DIAGNOSTIC CRITERION FOR PARTICLE-CONTAMINATED COMPRESSED GAS APPARATUS

M. Anis (1), M.M.A. Salama (2) and K.D. Srivastava (1)
(1) University of Waterloo, Waterloo, Ontario, Canada
(2) Al-Azhar University, Egypt

IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 6, pp 1584-1595 (06/1982)

The corona pulse voltage in SF₆/sub 6/ gaps, under impulse voltages, is random in value; its randomness is related to the electrode geometry and is influenced by the gas pressure and the rate of rise of the applied voltage. An analytical model is presented whereby the relationships among these quantities are derived. The model predicts for a given electrode geometry at a certain gas pressure the distribution of the corona onset voltage. The results of testing rod-plane SF₆/sub 6/ gaps under switching impulses are presented to verify the applicability of the analytical model. By establishing an electrostatic equivalence between rod-plane gaps and conducting particles in GIS, the above analysis could be extended to the latter problem. The possibility of using the present results and analysis to devise a diagnostic test procedure for particle-contaminated GIS is discussed. 9 Refs.

Primary Keywords: SF₆/sub 6/ Corona Pulse; Impulse Voltage; Electrode Geometry; Modelling; Onset Voltage Prediction;

No-nano-form Field Gap

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

10129

(POWER CONDITIONING)

(Pulse Transformers)

SOME TRANSMISSION LINE DEVICES FOR USE WITH MILLIMICROSECOND PULSES

J.A.C. Lewis
Radar Research Establishment
Electronic Engineering, Vol. 27, No. 33, pp 447-453 (10/1955).

Coaxial cables are very useful for implementing pulse transformers and phase inverters. This paper presents a brief theoretical background and design guides for such phase inverters and stacked-line pulse transformers. 8 Refs.

Primary Keywords: Phase Inverter; Impedance Transformers; Nanosecond Pulses; Value Monitor Isolating Transformer; Coaxial Cable

COPYRIGHT: 1955 HAYDEN PUBLISHING CO

10130

(SWITCHES; CLOSING SWITCHES; CLUSING)

(Thyristors; LASI)

THYRISTOR DEVICES FOR ELECTRIC POWER SYSTEMS

V.A.K. Temple
General Electric Co., Schenectady, NY 12301
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-101, No. 7, pp 2285-2291 (07/1982)

Thyristors of higher voltage and current ratings containing new gate and isolating structures are being developed at General Electric with EPRI support. Power Research Institute, Schenectady, some of the more important of these are described in this paper. Devices include light triggered thyristors (LT), all four of the 5 kV level and asymmetrically light triggered thyristors (ALT/1's) - from 50A higher current capability and fast turn-off times than in regular thyristors. New features include "soft" latched turn-on, which protects the diodes from destructive breakdown during turn-on, and voltage breakdown (VBD) protection, which prevents soft-latched avalanche current turn-on. Brief descriptions of recent devices and status reports of our various EPRI-supported programs are given. 8 Refs.

Primary Keywords: Thyristor; Switch; Light Triggered; High Current; Built-in Protection; Soft Turn-on; Voltage

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

10144

(BREAKDOWN STUDIES)

(Vacuum; Electrical)

ON THE CATHODE OF AN ARC DRAWN IN VACUUM

R. Tenborg
Westinghouse Electric Corp., Pittsburgh PA
Physical Review, Vol. 35, No. 9, pp 1380-1389 (05/1930).

It has been found that the cathode is the only electrode which contributes vapor for the maintenance of an electrical arc under very low gas pressure. The velocity of this vapor was determined by two methods. Method 1 consisted of measuring the force of reaction of the vapor on the cathode and the rate of vaporization of the cathode material. Method 2 consisted of determining the force exerted by the vapor on a wire suspended in front of the cathode spot and the rate of vapor condensation on the wire. Both these methods gave a vapor velocity of the order of 16x16 cm/sec. A temperature of around 50,000° Day X results when this value for the cathode vapor velocity is substituted for c in the equation: $1/2 mc^2 = KT$. 10 Refs

Primary Keywords: Vacuum Breakdown; Cathode Effects; Cathode Vapor; Vapor Velocity; Temperature Calculation

COPYRIGHT: 1930 AMERICAN PHYSICAL SOCIETY. REPRINTED WITH PERMISSION

10145

VACUUM VOLTAGE BREAKDOWN AS A THERMAL INSTABILITY OF THE EMITTING TIP

Breakdown by thermal instability of a field emitter is analyzed taking into account the temperature dependence of field emission and of resistivity. Beyond a certain temperature the emission increases while the necessary field drops. It is shown that for a whisker-like emitter this instability occurs when the emitting tip is only several hundred degrees centigrade hotter than the bulk of the cathode.

10165

(BREAKDOWN STUDIES)

(Electrolytes; Electrical)

ICE-BREAKDOWN PHENOMENA IN AQUEOUS ELECTROLYTES IN ULTRA-HIGH ELECTRIC PULSE FIELDS. PART I

A.I. Vorob'yev, V.V. Ryum, N.V. Semkin, O.P. Semkina and V.Ye. Usakov
Applied Electrical Phenomena, No. 3, pp 28-32 (06/1971).
Trans. From Elektronnaya Obrabotka Materialov 3, (1971).

Breakdown currents at high fields are studied in aqueous electrolytes. Several electrolytes with low voltage resistivities on the order of 100 ohm cm are subjected to rectangular pulses with fields up to 15000 V/cm. The pulse rise time is 1 nsec. Prebreakdown currents are measured as a function of field intensity and duration. The formation of a gas film near the electrodes is presented as a possible mechanism for current saturation. 10 Refs.

Primary Keywords: Aqueous Electrolytes; 150-160 V/cm Electric Pulse Fields; Pre-breakdown Currents; Voltage Duration; Electric Field Intensity; Near-electrode Gas Film Formation

COPYRIGHT: 1971 SCIENTIFIC INFORMATION CONSULTANTS

10168

(BREAKDOWN STUDIES)

(Surface Flashover)

DEVELOPMENT OF SURFACE DISCHARGE ALONG A DIELECTRIC WITH LARGE DIELECTRIC CONSTANT IN GAS IN THE NANOSECOND RANGE

B.M. Kovalevchuk, V.V. Kremnev, G.A. Mesyats and Ye.Ya. Yurik
Academy of Sciences of the USSR, Tomsk, USSR
Journal of Applied Mechanics And Technical Physics, Vol. 14, No. 1, pp 39-44 (11/1973).
Trans. From Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki 1, 49-55 (January 1973).

The discharge from a metallic edge along the surface of a dielectric with dielectric constant of the order of 100 or larger is investigated. The dependences of the rate of expansion of the discharge, the time lag, and the volt-ampere characteristics are determined for exposure times of the order of 10⁻⁹ sec for plates made of barium titanate, titanium dioxide, and steatite ceramic with thicknesses of the order of 1 mm or less at voltages up to 1.5 kV of different polarity. The average rate of expansion of the figure of luminosity along a discharge track is equal to 160 m sec⁻¹ in the order of magnitude. It is shown that from a negative point that discharge is initiated by the self-electron emission current, while from a positive voltage point it is initiated by the self-ionization current. The conclusions are given for a commutator utilizing surface discharge from a large number of points. 7 Refs.

Primary Keywords: Surface Discharge Development; Large Dielectric Constant; Discharge Expansion Rate; Volt-ampere Characteristics; Self-electron Emission Current; Self-ionization Current

COPYRIGHT: 1975 PLenum Press. REPRINTED WITH PERMISSION

10171

(PARTICLE BEAMS; ELECTRON; INSULATION; MAGNETIC)

(Experimental)

EXPERIMENTAL STUDY OF A MAGNETICALLY INSULATED DIODE FOR PULSE LENGTHS >1E-5 SEC

I.M. Poloz, V.A. Burtsev, M.A. Veselovsky and V.I. Engel'ko
Soviet Physics-Technical Physics, Vol. 25, No. 5, pp 570-577 (05/1980).
Trans. From Zhurnal Tekhnicheskoi Fiziki 50, 944-956 (May 1980).

Results of an experimental study of a magnetically insulated high-current diode are presented. It is demonstrated that the length of an electron current pulse in such a diode can be limited by breakdown along the surface of the accelerator chamber, caused by electrons escaping to the surface of the tube. Magnetic insulation of the accelerator has made it possible to achieve pulse lengths >1E-5 sec voltages >400 kV across the tube with electron beam currents of 4-6 kA. The study includes the dependence of the diode characteristics on the strength and the distribution of the magnetic field in the accelerating gap. The feasibility of using multiple-point large-surface-area cathodes to form cylinder electron current-emitting structures is demonstrated.

Primary Keywords: Magnetically Insulated High-current Diode; >1E-5 Sec; Electron Current Pulse Lengths; >400 kV Voltages; 4-6 kA Electron Beam Currents; Cylindrical Electron Beams; Multiple-point Large-surface-area Cathodes; Electron Flux

COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

- 10174
(BREAKDOWN STUDIES; SWITCHES, CLOSING)
 (Vacuum, Electrical; Vacuum Gaps, Electrical)
FORMATION OF NEW EMISSION CENTERS ON THE CATHODE IN THE PROCESS OF SWITCHING ELECTRICAL CURRENT IN A VACUUM III. THE EFFECT OF A TRANSVERSE MAGNETIC FIELD
 D.I. Proskurovskii and V.F. Puchkarev
 Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 25, No. 10, pp 1235-1239
 (10/1980).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki*, 50, 2120-2126 (October 1980)
 The formation of emission centers (EC) on the cathode when electrical current is switched in a transverse magnetic field is studied. It is shown that new EC arise in the direction of the plasma drift and they move with a velocity approximately $3E6$ cm/s. The mechanism for their origin is discussed. A qualitative model is proposed for explaining EC associated with anomalous motion of the cathode spot of the vacuum arc. 18 Refs.
Primary Keywords: Vacuum Breakdown; Emission Center Formation; Transverse Magnetic Field; Plasma Drift; Cathode Spot; Hot Spots; Closing Switch
COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10175
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
 (Surface; Flashover; Solid)
MICRODISCHARGES ON THE SURFACE OF A DIELECTRIC IN A VACUUM
 E.N. Abdulin and S.P. Bugayev
 Institute of Atmospheric Optics, Academy of Sciences of the USSR,
 Moscow, USSR
Soviet Physics Journal, Vol. 18, No. 2, pp 260-262 (02/1975).
 Trans. From: *Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika*, 18,
 152-154 (February 1975).
 It has been previously shown that for a slow rise in the voltage on a dielectric located in a vacuum, a predischARGE current is observed. This current has two components. One of them changes slowly in time, and its amplitude does not exceed $1E-11$ to $1E-7$ A, while the other consists of brief current surges of amplitude up to $1E-3$ A. The experiments conducted previously indicate the important role of the constant component of the predischARGE current in preparing the flashover process. Meanwhile, the reasons for the appearance of and the role of the microdischarges (self-extinguishing current surges which do not lead to breakdown) remain unclear. 7 Refs.
Primary Keywords: Microdischarges; PredischARGE Current; Dielectric Constant; Microscopic Spikes; Surface Dielectric Strength Increase
COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION
- 10177
(REVIEWS AND CONFERENCES; BREAKDOWN STUDIES)
 (Conferences; Exploding Wires)
EXPLODING WIRES: VOLUME IV
 W.G. Chace (Ed.) (1) and H.K. Moore (Ed.) (2)
 (1) AFCLR, Bedford, MA 01730
 (2) Lowell Technological Institute Research Foundation, Lowell, MA
 Publisher: Plenum Press, New York (01/1968).
 This book is the record of the Conference on Exploding Wire Phenomena held October, 1967 in Boston, MA. As in previous cases, this volume contains papers on the relation of shock waves and exploding wires; on uses, particularly as exploding bridge wires; on chemical reactions induced by wire explosions; and on the general theory of wire explosions. In addition, several new areas are covered. There are two papers on the resistivity-density relation in wire explosions. There are papers on the use of lasers and also on the use of x-rays for the study of exploding wires. Spectroscopy as applied to wire explosions is discussed in four papers. 286 Refs.
Primary Keywords: Exploding Wires; Vaporization Wave; Comparison To Spark Discharge; Optical Output; Magnetic Field; Standing Wave; Diagnostics
COPYRIGHT: 1968 PLENUM PRESS, REPRINTED WITH PERMISSION
- 10178
(ELECTROMAGNETIC FIELD GENERATION; REVIEWS AND CONFERENCES)
 (Magnetic; Reviews)
PULSED HIGH MAGNETIC FIELDS
 M. Kneepfle
 Lab. Gen. Ionizzati, Euratom-CHEN, Frascati, Italy
 Publisher: North-Holland Publishing Co.-Amsterdam (01/1970).
 This book considers all aspects of magnetic field generation. The author proceeds from a short discourse on electromagnetic field theory to a thorough presentation on pulsed magnetic field generation. Field generation using capacitor banks, inductive stores, and flux compression are discussed in detail. Aspects such as conductor deformation and vaporization are considered. A section on magnetic field and current measurement is included. 605 Refs.
Primary Keywords: Magnetic Field Generation; Field Theory; Capacitor Banks; Inductive Stores; Flux Compression; Field Effects; Conductor Deformation; Magnetic Pressure; Field Diagnostics
COPYRIGHT: 1970 NORTH-HOLLAND PUBLISHING CO.
- 10179
(PARTICLE BEAMS, ELECTRON)
 (Generation)
THE 'TEREK-2' HIGH-CURRENT PULSED ELECTRON ACCELERATOR
 Yu.F. Bonder, B.M. Kovalev, A.M. Rybelov and P.S. Streikov
 Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 17, No. 1, pp 17-19
 (02/1974).
 Trans. From: *Pribyr'i i Tekhnika Experimenta*, 1, 25-27
 (January-February 1974).
 A pulsed electron accelerator having a current-pulse amplitude of up to 10 kA and a pulse length of 30 nsec is described. The energy of the electrons in the beam may be controlled smoothly from 200 to 550 keV. The structural peculiarity of the accelerator allows injection of a beam into a quasi-stationary magnetic field without introducing substantial distortions into the field. 7 Refs.
Primary Keywords: 10 kA Current-pulse Amplitude; 30 nsec Pulse Length; 200-550 keV Beam Energy; High-current Pulsed Electron Accelerator; Pulse Autotransformer; Double Shaping Line
COPYRIGHT: 1974 PLENUM PRESS, REPRINTED WITH PERMISSION
- 10180
(BREAKDOWN STUDIES; INSULATION, MATERIAL)
 (Surface; Flashover; Solid)
BEHAVIOR OF COMPOSITE INSULATION UNDER THE ACTION OF SUPERFICIAL ARCS. APPLICATION TO LINE INSULATORS
 B. Ali, C. Kuraux and A.M. Rehrl
 Toulo se Univ. (France), Lab. de Genie Electrinique.
 Final Report, No. PUBL-378, 21c (12/1978).
 Availability: NBS-17375/0
 NTIS
 Laboratory measurements were made in order to define the flashover mechanism observed on high voltage line insulators. Surface discharge propagation is considered to be due to the build-up of pollutants on the insulator surface. The laboratory apparatus, consisting of an open channel filled with an electrolyte, is described. This device represents a simplified model of the electric equation under study. Variables are arc length, extent of polluted surface, and type as well as resistance of the electrolyte. Results show experimentally the lowest voltage at which an arc sufficient to short-circuit the electrolyte develops. Some possible applications of this data to the improvement of insulators are then discussed.
Primary Keywords: Flashover; Insulators; Power Lines; Surface Stability; Electric Arcs; Electrical Insulation; Electrolytes; Electrostatic Charge; High Voltages;
Secondary Keywords: IN FRENCH; NTISNASA; NTISFR
- 10181
(ELECTROMAGNETIC LAUNCHERS)
 (Exploding Wires)
ELECTRIC GUN: A VERSATILE TOOL FOR HIGH-PRESSURE SHOCKWAVE RESEARCH
 H.H. Chee (1), G. Dittnerer (2), W.W. Hofer (2), C.A. Monadel (2), D.J. Steinberg (2), J.R. Stroud (2), R.C. Weingart (2) and R.S. Lee (2)
 (1) Lawrence Livermore Lab., Livermore, CA 94550
 (2) Kansas State University, Manhattan, KS 66502
The Review Of Scientific Instruments, Vol. 51, No. 12, pp 1676-1681
 (12/1980).
 We have developed a versatile tool for generating planar shock waves. This system, which we call the electric gun, is capable of projecting thin flyer plates with velocities in the range 1-20 km/s. It is presently being used in high-explosives-initiation experiments and is being developed for equation-of-state measurements in the 1-7 TPa range. We describe the electric gun facilities that are operating at Lawrence Livermore Laboratory and discuss applications of electric gun technology to problems of interest to shock-wave researchers. 13 Refs.
Primary Keywords: Dielectric Pellet launcher; Exploding Wire; Shock Wave; 20 km/sec Velocity; Plastic/metal laminate
COPYRIGHT: 1980 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10182
(BREAKDOWN STUDIES)
 (Electrodes)
ELECTRODE MATERIAL RELEASE DURING HIGH VOLTAGE BREAKDOWN (FINAL REPORT)
 G.H. Lichten, T.B.I. Mc Call and R.T. Schneider
 University of Florida, Gainesville, FL
 No. NASA-R-107880, 118p (01/1969).
 Availability: N70-17442
 NTIS
Primary Keywords: Electrical Faults; Electrodes; Electron Emission; Electric Fields; Electric Potential; Electron Beams; Plasmas (physics); Vacuum Tubes
- 10183
(DIAGNOSTICS AND INSTRUMENTATION)
 (Data Transmission)
HIGH VOLTAGE INSTRUMENT CABLES FOR 650 DEG.C IN-VESSEL BREEDER REACTOR SERVICE
 C.P. Cannon
 Hanford Engineering Development Lab., Richland, WA.; Department of Energy
 No. ERDA-791037-5, 16p (07/1979).
 Availability: NED-54-10-3-4
 NTIS
 High insulated cables, instrument cables have been developed for use in the Fast Flux Test facility (FFTF) and breeder reactor in-vessel environments. Prototype cables have been successfully fabricated and tested. Voltage Breakdown Pulse Noise (BPN) thresholds in excess of 300 Vdc and cable resistivities in excess of 10×10^8 ohm m were achieved at temperatures to 650 exp 0 C. Factors demonstrated to strongly affect breakdown phenomena and insulation resistivity as affected by fabrication processing, compaction density, and high temperature annealing. Substitution of copper electrical conductors did not adversely affect cable performance if insulation parameters were appropriately adjusted. Preliminary gamma irradiation tests on bulk cables indicated that the gamma flux decreases insulation resistance by an order of magnitude to 5×10^{-3} exp 9 omega . ft at 450 exp 0 C. (ERA citation 05-008478).
Primary Keywords: Electric Cables; FFTF Reactor; Magfar Type Reactors; Breakdown; Electropol. Insulation; Magnesium Oxides; Performance; Pactor Instrumentation
Secondary Keywords: ERDA-212510, ERDA-220600; NTISDE Distribution Restriction: Microfiche copies only.
- 10184
(PULSE GENERATORS; SWITCHES, CLOSING)
 (Pulse Forming Lines; Gas Gaps, Electrical)
HIGH VOLTAGE NANOSECOND PULSE GENERATOR
 C. Zavales
 EG&G, Fort Monmouth, NJ 07703
 Interim Tech. Rep. no. 5, 1 May-31 Oct 79 (07/1980).
 Availability: AD-A087-291/1
 NTIS
 A parallel Blumlein circuit, combined with a spark gap switch, was designed for operation at 24 kV, 5,000 A peak. Tests were conducted with a single Blumlein with a 10 ohm load. Because of problems with breakdown in the triggered spark gap, a slightly larger spark gap was substituted. An acceptable pulse is delivered from the pulse forming network after adjustment of the inductive elements in the network.
Primary Keywords: Pulse Generators; Tee Lasers; Trigger Circuits; Spark Gaps; Electrical Networks; Electrical Loads; High Voltage; Pulse Rate; Transistors
Secondary Keywords: Blumlein Circuits; Avalanche Transistors; NTISDODXA; NTISDDODA

10185
(BREAKDOWN STUDIES; INSULATION; MATERIALS)

(Gas; Electrical; General)
HIGH VOLTAGE RESEARCH (BREAKDOWN STRENGTHS OF GASEOUS AND LIQUID INSULATORS) AND ENVIRONMENTAL EFFECTS OF DIELECTRIC GASES. SEMIANNUAL REPORT, APRIL 1, 1979-SEPTEMBER 30, 1979

L.G. Christophorou, D.R. James, R.Y. Pei, R.A. Mathis and I. Sauers
Doe Ridge National Lab., Oak Ridge, TN 37830
(01/1980).

Ava: Availability: ERNL/TM-7173
NTIS

A number of gas mixtures are suggested for industrial-scale testing. Electron attachment rates were measured and unfolded to give attachment cross section functions for CCl₄ sub 3 F, CCl₄ sub 2 F sub 2 , and CCl₄ sub 3 each in N sub 2 , and for CCl₄ sub 3 F in Ar. Electron attachment rates were measured also for n-C sub 6 F sub 14 in both Ar and N sub 2 . The effects of molecular structure on energy, cross section, and lifetime of negative ion states of organic molecules are discussed. The potential role of electron detachment in inhibiting breakdown was investigated. The role of synergisms among constituents of a gas dielectric mixture is discussed. Examples are cited from recent breakdown measurements. Breakdown measurements in plane-plane geometry were made for CF sub 4 , 1,1,1-CH sub 3 CF sub 3 , and CHF sub 3 . Similar measurements were conducted with binary mixtures containing one of (c-C sub 4 F sub 8 , SF sub 6) and one of (CF sub 4 , CH sub 2 F sub 2 , 1,1,1-CH sub 3 CF sub 3 , CH sub 2 F sub 2). Of special interest in these results were observed synergisms and the effect of dipole moment on the breakdown strengths. The initial fragmentation of 1,1,2-C sub 2 Cl sub 3 F sub 3 under electron impact was studied. Final decomposition products of sparked SF sub 6 /2-C sub 4 F sub 6 mixtures were identified and quantified. The breakdown products of SF sub 6 were studied. Impulse measurements were made.

Primary Keywords: Chirped Aliphatic Hydrocarbons; Dielectric Materials; Fluorinated Aliphatic Hydrocarbons; Fluorinated Aromatic Hydrocarbons; Hexane; Sulfur Fluorides; Anions; Breakdown; Cross Sections; Electric Fields; Electron Attachment; Electron Detachment

Secondary Keywords: ERDA/360603; ERDA/640304; Dielectric Breakdown; NTISDE

10186
(DIAGNOSTICS AND INSTRUMENTATION)

(Systems)

MEASUREMENT TECHNIQUES FOR HIGH POWER SEMICONDUCTOR MATERIALS AND DEVICES. ANNUAL REPORT, OCTOBER 1, 1977-SEPTEMBER 30, 1978

National Bureau of Standards, Washington, DC National Engineering Lab.; Department of Energy.

No. NBSIR-79-1756, 144p (10/1979).

Availability: DOE/RA-8041

NTIS

Results of NBS research directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high-power semiconductor devices in applications for energy generation, transmission, conversion, and conservation are reported. It responds to national needs arising from the rapidly increasing demands for electricity and the present crisis in meeting long-term energy demands. Emphasis is on the development of measurement methods for materials for thyristors and rectifier diodes. Application of this measurement technology will, for example, enable industry to make devices with higher individual power-handling capabilities, thus permitting very large reductions in the cost of power-handling equipment and fostering the development of direct current (dc) transmission lines to reduce energy waste and required rights-of-way. The major tasks under this project are to evaluate the use of thermally stimulated current and capacitance measurements and other deep level measurement techniques as a means for characterizing lifetime-controlling or leakage source defects in power grade silicon material and devices and to develop procedures to enable spreading resistance measurements of thyristor storage material to obtain carrier profiles to be made on a self-consistent basis. (ERA citation 05-006059)

Primary Keywords: Semiconductor Devices; Semiconductor Materials; Measuring Methods; Operation; Performance Testing; Research Programs

Secondary Keywords: ERDA/420800; NTISDE

10188
(ENERGY STORAGE; MECHANICAL; ENERGY STORAGE; INDUCTIVE; SWITCHES, OPENING; SWITCHES, OPENING)

(Rotating Machines; Inductors; Mechanical; Explosive Fuses)
DESCRIPTION OF THE ENERGY SOURCE PROJECT DELIVERING 1 MEGAJOULE IN 1 MICROSECOND

F. Demidau and C. Rioux
Paris University, Orsay, France

No. LF-3, 14p (05/1977).

Availability: NTIS

The project for a high energy source delivering one MJ in one microsecond using a unipolar autoexcited ironless rotating generator is presented. Three subsystems are detailed: (1) the primary source mentioned above, delivering one MJ in 0.1 second with one MA current coupled to a magnetic storage coil, (2) a primary transfer coil with high efficiency (transfer time 100 microseconds and associated switching gear), and (3) a secondary transfer coil to reach one microsecond. Circuit breakers required for the various connections are detailed with regard to mechanical devices and insulation wire techniques. Mutually coupled inductances used for high efficiency transfer are described and the sequence of switch operations detailed. Primary Keywords: Circuit Breakers; Electric Energy Storage; Electrical Engineering; Electromechanical Devices; Impulse Generators; Electric Fuses; Electric Power Transmission; Electrical Insulation; Energy Conversion Efficiency; Inductance

Secondary Keywords: NASA

10189
(ENERGY STORAGE; MECHANICAL; SWITCHES, OPENING)

(Rotating Machines; Mechanical)
FUSION R/D ON ADVANCED FUELS, HOMOPOLAR GENERATORS, CIRCUIT BREAKERS AND TOKAMAK DIAGNOSTICS

H.E. Drummond
University of Texas at Austin, Electric Power Research Inst., Palo Alto, Calif.
Final rept. (09/1975).

Availability: PB-248 322/05T
NTIS

The general purpose of this program was two-fold: (1) To investigate theoretically the potential for the use of advanced fuel cycles and direct conversion in tokamak systems and the development of automated data acquisition systems for tokamaks; and (2) to explore both theoretically and experimentally the potential of homopolar generators and inductive energy storage devices as power supplies for future fusion experiments. The general outline of the program is discussed; a detailed description of the work done in each area is given; and a budget showing the actual expenditures incurred in the performance of the work is given.

Primary Keywords: Nuclear Fusion; Nuclear Fuel Cycles; Circuit Breakers; Energy Storage; Numerical Analysis

Secondary Keywords: Tokamaks; NTISERPI

10190
(PULSE GENERATORS)

(Trigger)
HIGH SPEED TRIGGER SYSTEM FOR TOTAL DEPOSITED ENERGY MEASUREMENT IN A LIQUID ARGON CALORIMETER

J.E. Grund
Stanford Research Institute, Menlo Park, CA 94025
No. CONF-781033-28, Sp (10/1978).

Availability: SLAC-PUB-2216

NTIS

A system to produce trigger signals measuring the total energy deposited in the liquid argon/lead shower counters of the SPEAR Mark II Detector at the Stanford Linear Accelerator Center is described. The trigger signals are developed by summing, filtering, and discriminating the signals from several thousand preamplifiers connected to the liquid argon detector strips. The system requirement of trigger information 430 ns after a particle has entered the shower counter led to a special filter design in which a leading edge sampling technique was utilized. A limited time window during the total deposited energy is measured by a fast level discriminator that is strobed in synchronization with the $e^+ e^- e^+ e^-$ beam crossings of the SPEAR storage ring. This sampling of the filtered waveform produces a digital output that is delivered to the trigger logic. (ERA citation 04-024387)

Primary Keywords: Shower Counters; Trigger Circuits; Amplifiers; Argon; Design; Efficiency; Filters; Liquids; Logic Circuits; Preamplifiers; Signals; Stanford Linear Accelerator Center

Secondary Keywords: ERDA/440104; ERDA/430303; NTISDE

10191
(BREAKDOWN STUDIES)

(Electrodes)

HIGH VOLTAGE BREAKDOWN INITIATED BY PARTICLE IMPACT

J.F. Frichtenstein, D.O. Hansen and J.C. Slattery

Space Technology Labs Inc., Redondo Beach, CA

No. NASA-CR-63185, 5p (04/1965).

Availability: N67-25407

NTIS

Primary Keywords: Electrode; Gap; Impact; Particle; Voltage Breakdown; Acceleration; Breakdown; Dependency; Experiment; Formation; Gas; High Voltage; Polarity; Steel; Stress; Voltage

10192
(BREAKDOWN STUDIES; SWITCHES, CLOSING)

(Vacuum; Electrical; Vacuum Gaps, Self)

EMISSION CHARACTERISTICS OF AN EXPLOSIVE GALLIUM CATHODE

G.N. Fursikov and V.M. Zhukov
A.I. Zhdanov Saratov State University, Tanningrad, USSR
Soviet Physics-Technical Physics, Vol. 19, No. 6, pp 884-897 (12/1974).

Transl. From: Zhurnal Tekhnicheskoi Fiziki 4, 1280-1286 (June 1974).
The temporal characteristics and emission properties of the initial stages of vacuum breakdown are studied. An attempt is made to distinguish processes related to the parameters of the external circuit from those due directly to the emission properties of the cathode. The delay times and switching times are measured during the development of vacuum breakdown on the surfaces of liquid and solid gallium with a limited emitting surface and on extended electrodes. The explosive-emission current displays saturation due to the limited cathode emissivity. 10 Refs.

Primary Keywords: Vacuum Breakdown; Explosive Cathode Emission; Temporal Resolution; Delay Measurement; Switching Time Measurement

COPYRIGHT: 1974 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10193
(BREAKDOWN STUDIES)

(Electrodes)

HIGH-VOLTAGE CHARACTERISTICS OF A LARGE-GAP COAXIAL-CYLINDER ELECTRODE

K.F. Koral
Lewis Research Center, Cleveland, OH

No. NASA-TN-D-3949, 24p (05/1967).

Availability: N67-24617

NTIS

The splicing and termination of underground electrical distribution cable requires that the integrity of the conductor and insulation be maintained throughout its length. A large number of commercial cable splice and termination kits are available which are claimed to fulfill these requirements. The Civil Engineering Laboratory (CEL) was requested to investigate the suitability of these kits for use at Naval shore facilities. Of special interest were the slip-on cable splice and cable termination for solid dielectric insulated cable. These slip-on devices proved to be the easiest and fastest to install with good reproducibility, and the electrical characteristics were as good as, or better than, the other types of cable splice and cable termination kits tested. (Author)

Primary Keywords: Concentric Cylinder; Electrode; Performance Characteristics; Conditioning; Current; Electrogenerator; High Voltage; Insulation; Leakage; Micropulsation; Rate; Solid; Vacuum

10194
(INSULATION, MATERIAL)
(Solid)

DESTRUCTION OF POLYMER DIELECTRICS BY PARTIAL DISCHARGES
M.A. Bagrov, M.A. Kurbanov and E.A. Garagashay
Institute of Physics, Academy of Sciences of the Azerbaijdzhan SSR,
Sekur USSR
Soviet Physics-Technical Physics, Vol. 20, No. 1, pp 55-57 (07/1975).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 45, 93-96 (January 1975).
The influence of the energetic characteristics of individual
microscopic discharges on the destruction (erosion) of polyethylene
has been studied. The destruction of a polymer dielectric by partial
discharges is shown to be due primarily to the energy which is
transferred directly to the surface of the dielectric where it is in
contact with the microscopic discharges. 5 Refs.
Primary Keywords: Polyethylene Insulation; Partial Discharges;
Insulation Destruction; Microscopic Discharge;
Energy Release

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

10198

(BREAKDOWN STUDIES)

(Vacuum, Electrical)
THERMAL ANODE INSTABILITY IN THE PREBREAKDOWN STAGE OF VACUUM BREAKDOWN
V.A. Nevorovskii
All-Union Institute, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 11, pp 1317-1322
(11/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 2301-2308 (November 1978).
Anode heating by the prebreakdown field-emission current is
studied. Evaporation of the anode and of adsorbed films on the anode
is examined. In the prebreakdown stage of vacuum breakdown, the anode
heating can become unstable even before an electron-ion avalanche
appears in the vapor. This instability is due to the additional heat
evolution at the anode which results from increased electron current
associated with ionization of the vapor produced by the hot anode.
28 Refs.

Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Anode
Heating; Metal Vapor; Electron Avalanche; Ion
Avalanche

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

10199

(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Vacuum, Electrical; Electrodes)

MOTION OF THE CATHODE SPOT OF A VACUUM ARC IN AN INHOMOGENEOUS MAGNETIC
FIELD

I.I. Akhiezer and A.A. Andreev
Kharkov Physicotechnical Institute, Academy of Sciences of the
Ukrainian SSR, Kharkov, USSR
Soviet Technical Physics Letters, Vol. 3, No. 12, pp 525-526 (12/1977).
Trans. From: Pis'ma Zhurnal Tekhnicheskoi Fiziki 3, 1272-1275
(December 1977).

6 Refs.

Primary Keywords: Vacuum Arc; Cathode Spot; External Magnetic Field;
Spot Motion; Retrograde Motion; Cold Cathode

COPYRIGHT: 1978 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

10200

(ELECTROMAGNETIC COMPATIBILITY)

(Lightning)

LIGHTNING EFFECTS RELATING TO AIRCRAFT: PART II. CHARACTERISTICS OF
SIMULATED LIGHTNING FLASHES AND THEIR EFFECTS ON LIGHTNING ARRESTERS
AND AVIONIC EQUIPMENT

F.A. Fisher, B. Macchiaroli and D.L. Jones
General Electric Co., Pittsfield, MA 01201
Final rep't. 15 Nov 69-15 Oct 71 No. SRD-72-054-2, 94p (01/1972).
Availability: AD-900 245/251
NTIS

Measurements were made of the degree to which a lightning arrester
could limit the voltage on avionic equipment when an external
lightning arrester was struck by a simulated lightning stroke. The
tests show that breakdown is not an instantaneous effect, but rather
takes many microseconds. Measurements of the point which is
struck during the stroke around any protrusions will be in a
state of electrical breakdown whenever the electrical field strength
at the aircraft surface approaches 100 KV/meter. Electrical
discharges tend to limit the field strength to that value, thus
defining the electrical environment to which the avionics equipment
is subjected. Data is presented showing how the impedance affects the
voltages impressed on avionic equipment before the spark gaps in the
protecting lightning arrester break down. Measurements were made of
the spectral density of radiation from long electrical arcs used to
simulate lightning strokes to aircraft. The relative amplitude at
different frequencies seems to agree with that observed from natural
lightning, falling off at rates in the vicinity of 10 Hz. (Author-Pl.)

Primary Keywords: Lightning Arrestors; Aircraft; Airframes; Lightning;
Simulation; Burning Rate; Airplane Panels; Sparks;
Shock Waves; Composite Materials; Acoustic
Impedance; Electromagnetic Shielding; Electric
Fields; Electric Arcs; Voltage; Air; Electrodes;
Damage

Secondary Keywords: Avionics; F-106 Aircraft; F-4 Aircraft; NTISDODXO
Distribution Restriction: Distribution limitation now removed.

10201
(ELECTROMAGNETIC COMPATIBILITY)

(Lightning)

LIGHTNING EFFECTS RELATING TO AIRCRAFT: PART III. MEASUREMENTS OF
LIGHTNING-INDUCED VOLTAGES IN AN F4H-1

J.A. Plumer
General Electric Co., Pittsfield, MA 01201
Final rep't. Nov 71-Jan 73 No. SRD-72-054-3, 122p (03/1973).
Availability: AD-910 158/557
NTIS

Measurements of possible lightning-induced voltages on several
electrical circuits within an F4H-1 aircraft are reported. The
measurements were made using the transient analysis technique in
which simulated lightning currents identical in waveshape but reduced
in amplitude to those of natural lightning are passed through the
aircraft. The resulting induced voltages are then scaled upward in
direct proportion to natural lightning amplitudes. When scaled to a
scale lightning stroke of 200,000 amperes as described in report
MIL-B-5087B, Para. 3.3.4.5, voltages induced in the measured circuits
ranged between several millivolts and several thousand volts. Factors
influencing the susceptibility of a particular circuit included
circuit routing, function, electrical return path and exposure to
direct contact with lightning currents at extremities such as NAV
lights and pitot heaters. The circuits receiving the highest induced
voltages include those in which associated components have been
damaged as reported in actual F-4 lightning strike incident reports.
The results indicate that a combination of voltage limiting spark gap
devices and lower voltage surge suppressors may be effective in
limiting many of these voltages to safe levels, but the maximum
transient voltage withstand levels of connected avionic and power
system equipment should be determined before maximum safe voltage
limits can be established. The advent of solid state avionics and
nonmetallic structural materials in future aircraft

Primary Keywords: Lightning; Jet Fighters; Jet Fighters; Electrical
Equipment; Composite Materials; Circuits;
Interference; Lightning Arresters; Electromagnetic
Compatibility

Secondary Keywords: Avionics; F-4 Aircraft; Lightning Strikes;
Sidewinders; NTISDODXO

Distribution Restriction: Distribution limitation now removed.

10204
(ELECTROMAGNETIC COMPATIBILITY)

(Grounding And Shielding)

R.F. SHIELDING PERFORMANCE OF REINFORCED METAL FILLED CONDUCTIVE
PLASTIC FLAT GASKETS

J.E. Ehrreich and M. Nimoy
Chomerics, Inc., Plainville, MA
IEEE Transactions on Electromagnetic Compatibility, Vol. 7, No. 1, pp
50-54 (03/1965).

A paper presented at the Fifth Annual Symposium introduced this
group to the remarkable R.F. shielding potentials of the electrically
conductive plastic materials based on the new types of spherical
metal fillings. It was stated in this paper that the conductive
plastics have volume resistivities of about 10¹⁰-10¹¹ ohm-cmimeters
and when properly used in a flange would give total attenuations in
the range of 75 to 100 db over the frequency range of 50 kc to 10 Gc.
Further testing during the past year has established that these are
conservative figures. 1 Refs.

Primary Keywords: Conductive Plastic; EMC Shielding; 100 db
Attenuation; 75 KHz-10 Ghz Bandwidth; Easily Machined

COPYRIGHT: 1965 IEEE, REPRINTED WITH PERMISSION

10206
(ELECTROMAGNETIC COMPATIBILITY)

(Grounding And Shielding)

SHIELDING EFFICIENCY OF ELECTRICALLY CONDUCTIVE PROTECTIVE COATINGS FOR
MAGNESIUM AND ALUMINUM SURFACES

A.L. Albin
Fairchild Space and Defense Systems, Syosset, NY
IEEE Transactions on Electromagnetic Compatibility, Vol. EMC-6, No. 2,
pp 31-35 (07/1964).

Although several proprietary finishes have been available for
aluminum and magnesium protection from corrosion, the electrical
properties at radio frequencies have never been sufficiently defined.
In order to evaluate the relative merits of such finishes for
aluminum and magnesium, a test program was established. Fixtures were
designed to measure bonding impedance from DC to RF, and to evaluate
shielding efficiency and insertion loss from gaskets used in joint
interfaces. Marked differences in performance were observed between
the radio frequency shielding obtained at radio frequencies and the
bonding impedance measurements, indicating that the commonly used
criterion of DC or RF bonding impedance is not sufficiently sensitive to
provide good control of conductive coatings. Corrosion tests
indicated several finishes which are acceptable from both the
corrosion and electrical viewpoint. 1 Refs.

Primary Keywords: EMF Shielding; Wideband Measurement; Moving Parts;
Corrosion Resistance; Metal Coatings; Life Test

COPYRIGHT: 1964 IEEE, REPRINTED WITH PERMISSION

10209
(SWITCHES, OPENING)

(Explosive Fuses)

THE PERFORMANCE OF ELECTRICAL FUSES UNDER IMPULSIVE CONDITIONS I:DC

C.P. Wheeler
Imperial College Of Science And Technology, London, UK
Journal Of Physics D: Applied Physics, Vol. 5, No. 1, pp 133-140
(01/1972).

The action integral is used to evaluate the rupturing times and
rupturing currents of fuse elements in inductive circuits. With a
suitable choice of variables it is shown that all fuses and circuits
can be represented by one equation and there is excellent
agreement with measurements made on copper fuses. Particular
attention is given to the stored magnetic energy at the time of
rupture, since this energy has to be dissipated in the ruptured fuse
material. Again, with a suitable choice of variables, a general
relation between current cut-off ratio and prearcing energy is
derived. The existence of a maximum in the relation has been known
for many years but the present paper puts this whole matter on an
general quantitative basis. Impulsive performance is considered in
conjunction with steady-state performance in a quest for the best
fuse element material. Silver appears to be the outstanding material,
with the much-used copper some way down in the list of metals.
Finally, the impulsive pressure produced in cartridge fuses is
considered and good qualitative agreement with measurements obtained
in the case of a treatment based on radiation pressure. 12 Refs.

Primary Keywords: Explosive Fuse; Inducti Creepage Discharge; Tap
Water; Dielectric Surface; Flange Length; Solid
Permittivity; Field Configuration; Pulse Length

COPYRIGHT: 1972 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10210
(BREAKDOWN STUDIES)
(Vacuum, Electrical)

THE ROLE OF POSITIVE IONS IN HIGH VOLTAGE BREAKDOWN IN VACUUM
H.C.J.C.R.W. Bourne and J.G. Trump
Massachusetts Institute of Technology, Cambridge, MA
Availability: PB-168 912
NTIS

Measurements were made of the electron emission from targets of aluminum, steel, magnesium, copper, gold, and lead when bombarded by ions from hydrogen, helium, nitrogen, xenon, and mercury. The ions, whose energy was varied over the range from 10 to 160 kilovolts, were produced by ionization of the residual gas in the anode electrode and emerged through a small opening into an essentially uniform acceleration field. An increase in ion current led to electron emission with ion energy was followed in all cases but a slow linear increase. The emission ratio varied from 2 to 20 and was maximum for the hydrogen ions or steel. The dependence on electric field gradient at the bombarded metal surface was slight and no simple dependence on the nature of the ion or of the bombarded metal was observed. The significance of these measurements on the electron-ion interaction theory of high voltage breakdown in vacuum is discussed. (Author)

Primary Keywords: Ion Bombardment; Vacuum; Secondary Emission; Metals; Electrons; Ions; Voltage; Gas Ionization; Aluminum; Steel; Magnesium; Copper; Gold; Lead; Hydrogen; Helium; Nitrogen; Xenon; Mercury

10211
(PULSE GENERATORS)
(Capacitor Banks)

CUPRIN' PULSE GENERATOR WITH AMPLITUDE OF 1,000,000 A AND STABILITY OF +0.1% -0.001 AT A REPETITION RATE OF TWO Hz
B.F. Beyanov, A.V. Il'in, V.M. Pakin, A.P. Panov and G.I. Silvestrov
FID Wright-Patterson AFB, OH
No. FID-IDCRS17-1291-77, 16p (08/1977).

Transl From: Trudy Vsesoyuznogo Soveshchaniya po Uzkoriteniyam Zaryazhennykh Chastits, Vol. 1, pp 283-286 (1970) By C.S. Mack

Availability: AD-A049 390/85T
NTIS

It is often necessary to create powerful generators which operate on an inductive load in order to obtain strong magnetic fields, as in particle beam systems and acceleration equipment. Furthermore, experimental conditions sometimes place limitations on the duration and form of the current pulse and the stability of current amplitude, and also require high operating reliability. This report examines a generator which provides a unipolar sinusoidal current pulse with a base length of 1.2 ms and an amplitude of 1,000,000 amperes. It is stable with precision of + or - 0.001 at a repetition rate of several hertz for an inductive load of 0.1 microhenry.

Primary Keywords: Pulse Generators; Inductance; Acceleration; Magnetic Fields; Gates(Circuits); Reliability(Electronics); Thyristors; Pulse Transformers; Voltage Regulation; Capacitors; Transistors; USSR

Secondary Keywords: NTISODDXA

10213
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

POSSIBILITY OF USING A HOMOPOLAR GENERATOR AS A PULSE GENERATOR
A.K. Das Gupta
Regional Engineering College, Rourkela, Orissa, India
IEEE Transactions on Power Apparatus And Systems, Vol. PAS-87, No. 3, pp 650-655 (03/1968)

A homopolar machine has been analyzed to ascertain whether it is possible to use it as a high-current, low-voltage pulse generator. A transient expression for the total flux has been deduced and the time constant determined. The effect of the eddy currents produced in the solid metal body of the machine has been included and an expression for the flux density due to eddy currents has been deduced, as well as an expression for the transient current in the magnetizing coil. 7 Refs.

Primary Keywords: Homopolar Generator; Horizontal Design; Theory; Field Flux Expression; Eddy Currents; Transient Current Calculation

COPYRIGHT: 1968 IEEE, REPRINTED WITH PERMISSION

10214
(ENERGY STORAGE, MECHANICAL)
(Rotating Machines)

PULSED HIGH-VOLTAGE AND HIGH-CURRENT OUTPUTS FROM HOMOPOLAR ENERGY STORAGE SYSTEM
R.D. Ford, D. Jenkins, W.H. Lupton and J.M. Vitko (eds.)
Naval Research Lab., Washington, DC 20375
The Review Of Scientific Instruments, Vol. 52, No. 5, pp 694-697 (05/1981).

Pulsed energy source with a versatile output, using self-excited homopolar generator for the initial storage of energy, has been developed. Large energy storage of this inertial-inductive system provides an attractive option for satisfying pulse power requirements associated with such applications as plasma confinement and heating, electromagnetic acceleration of projectiles, and with production of intense radiation. These applications require high rates of energy delivery to the load at specific current and voltage levels, have been obtained by incorporating unique current interrupting system. The overall pulsed energy storage depends sensitively on the load characteristics as measured over a range from 10% to more than 90% for different pulser-load circuit arrangements. 10 Refs.

Primary Keywords: Self-excited Homopolar Generator; Inductive Storage; Transfer Efficiency; Operating Switch; Load Considerations

COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10215
(BREAKDOWN STUDIES)
(Surface Flashover)

TEMPERATURE DEPENDENCE OF SURFACE FLASHOVER VOLTAGE OF POLYETHYLENE IN VACUUM
Y. Onki and K. Yehagi
Waseda University, Tokyo, Japan
Journal of Applied Physics, Vol. 46, No. 8, pp 3695-3698 (08/1975).

The surface flashover voltage over cylindrical spacers made of polyethylene in vacuum under impulse voltage application decreases monotonically with increasing temperature of the sample surface. This temperature dependence may be explained well by the mechanism that electrons injected from a cathode-insulator-vacuum junction bombard the sample surface to cause desorption of adsorbed gases and vaporization of sample material, thereby triggering surface flashover. 5 Refs.

Primary Keywords: Surface Flashover; Polyethylene; Vacuum; Impulse Voltage; Surface Preparation

COPYRIGHT: 1975 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10217
(BREAKDOWN STUDIES)
(Gas, Recovery)

ELECTRON ATTACHMENT IN SULFUR HEXAFLUORIDE USING MONOENERGETIC ELECTRONS
W.M. Hickam and R.E. Fox
Westinghouse Research and Development Center, Pittsburgh PA

The Journal Of Chemical Physics, Vol. 25, No. 4, pp 642-647 (10/1956).

Results are presented of an experiment to determine the attachment processes leading to formation of SF₆⁻ and SF₆²⁻ ions.

Homoenergetic electrons were used to determine the attachment cross section for several energies. The significance of the attachment cross section variation is discussed with respect to measuring electron energy distributions. 9 Refs.

Primary Keywords: SF₆⁻; Attachments; SF₆²⁻; Attachment; Attachment Cross Section; Variation With Energy

COPYRIGHT: 1956 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10218
(BREAKDOWN STUDIES)
(Gas, Recovery)

INVESTIGATIONS OF THE PROPERTIES OF SF/SUB 6/ AS AN ARC QUENCHING MEDIUM
W. Hertz, H. Motschmann and H. Wittel
Siemens AG Research Lab., Erlangen, FRG

Proceedings Of The IEEE, Vol. 59, No. 4, pp 485-492 (04/1971).

The results of experiments on stationary and nonstationary arcs in SF₆ are summarized. High temperature gas properties, like the electrical and thermal conductivity as well as the theoretically predicted plasma deionizing effects, are determined by electrical and spectroscopic measurements. Investigations on interrupted DC arcs give some insight into the transport mechanisms of SF₆ arcs. The transition temperature behavior of SF₆ arcs blast interrupted and is measured. Finally, the application of the investigations to circuit breaker arcs is discussed. The following principal results have been found. From the lower time constant of blown N₂/SF₆ arcs in comparison to SF₆ arcs above 10000 K it follows that the good quenching properties of SF₆ must be due to processes taking place below 10000 K. This agrees also with the time-constant measurements in the interrupted cascade arc; at lower temperatures below approximately 8000 K the conductance decay in N₂/SF₆ is very much slower than in SF₆. 13 Refs.

Primary Keywords: SF₆/Arc Quenching Properties; High-temperature Electrical Conductivity; Thermal Conductivity; Energy Transport; DC Arc Interruption; AC Arc Interruption; Gas Blast Circuit Breaker

COPYRIGHT: 1971 IEEE, REPRINTED WITH PERMISSION

10219
(BREAKDOWN STUDIES)
(Gas, Electrical)

THE INFLUENCE OF GAS STREAMS AND MAGNETIC FIELDS ON ELECTRIC DISCHARGES: PART 5-ARCS AT PRESSURES UP TO 18 ATMOSPHERES IN ANNULAR GAPS

V.W. Adams
Aeronautical Research Council (Gr. Brit.)
No. ARC-CP-985, 22p (01/1968).

Availability: H69-13425
NTIS

Primary Keywords: Angular Velocity; Arc Discharges; Gas Streams; Magnetic Annular Arc; Magnetic Fields; Carbon Arcs; Electric Arcs; Nitrogen; Pressure Effects; Propagation Velocity; Rotation; Spark Gaps

10220
(PULSE GENERATORS)

(Capacitor Banks)

HIGH VOLTAGE, HIGH CURRENT, PULSED ENERGY SOURCE HAVING DI/DT'S OF 2E12 A/S

L.C. Burkhardt, R.S. Dike, J.M. DiMarco, R.A. Heerman and A.E. Schofield
Los Alamos National Lab., Los Alamos, NM 87545
No. CONF-75125-1, 4p (01/1975).

Availability: LA-UR-75-2129
NTIS

A hybrid transfer capacitor circuit, combining one back-biased and a forward-biased capacitor bank, plus a resistor (for damping and isolation) and an inductive load has achieved inductive storage, explosive fuse-like rates of rise, and peak amplitudes, of currents. Initial dI/dt's of approximately 2E12 A/s are measured, with currents in the 200 kA range. The combination of explosive fuses and magnetic energy storage has been successfully used at Los Alamos Scientific Lab. to obtain currents with risetimes of 2E-12 A/s and of 200 kA magnitude, on both linear and toroidal Z pinches. Such a system must have the characteristic of inductively high voltage E-fields during the formation of the pinch, built with a resistor E-fields along the plasma chamber's wall after the pinch has been formed. The voltage left on a simple capacitor system will cause secondary wall breakdown, which short-circuits the previously formed pinch. (Conceivably a crowbar of extremely low inductance could then remove the residual voltage; in practice, however, the attendant L/R decay time is too short for most pinch experiments.).

Primary Keywords: Power Supplies_Performance; Energy Storage_Performance; Toroidal Pinch Devices_Power Supplies; Linear Z Pinch Devices_Power Supplies; Capacitors; Switching Circuits

Secondary Keywords: NTISERDA

10221
(PULSE GENERATORS; PULSE GENERATORS)

(Marx, Systems)

HIGH-VOLTAGE SYSTEM FOR THE RISK FACILITY: PART 1. BIPOLAR GENERATOR MODEL OF VOLTAGE PULSES WITH THE AMPLITUDE UP TO 200 KV

L.S. Vertogradov, A.V. Zhelakov, K. Ryuger and G.A. Shelkov
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976).

Availability: JINR-R-13-9740
NTIS

A bipolar high-voltage pulse generator intended for supplying large streamer chambers is described. This new type of the generator may be regarded as two Arckie-Marx generators assembled so that the first controlled discharge is common for both the generators. This unique high voltage source of short-pulse pulses is composed with a system consisting of two independent unipolar generators. Test results of a bipolar generator model are presented as histograms and dependences of principal characteristics upon external parameters. Based upon the results obtained the following conclusions have been drawn: output signal amplitudes hardly depend upon trigger amplitudes; optimum operating conditions of the generator with respect to pressure and supply voltage are close to the generator self-triggering region; all the parameters of the generator do not depend upon response frequency ranging from 2 to 6 cps. (Atomindex citation 09-376662).

Primary Keywords: High-voltage Pulse Generators; Streamer Spark Chambers; Capacitors; Diagrams; Electrodes; Frequency Dependence; Performance Testing; Resistors; Share

Secondary Keywords: The RISK; ERDA/460300; USSR; NTISINIS Distr button Restrict on: U.S. SALES ONLY.

10222
(INSULATION, MATERIAL)
(Gas)

SULFUR HEXAFLUORIDE

J.T. Milak
Hughes Aircraft Co., Culver City, CA 90230
Data sheets No. ds-140, 2p (10/1964).
Availability: AD-607 949
NTIS

A compilation of the electrical properties of sulfur hexafluoride, a dielectric gas, is presented. Electrical properties include corona, dielectric constant, dissipation factor and dielectric strength. The latter property data section is segregated into parameter effects as follows: pressure; gap distance; temperature; electrode configurations; and gas mixtures. Each property is compiled over widest possible range of parameters obtained in a thorough search of the world's literature. (Author)

Primary Keywords: SULFUR COMPOUNDS; FLUORIDES; FLUORIDES-SULFUR COMPOUNDS; ELECTRICAL PROPERTIES; DIELECTRICS; DATA; GRAPHICS; DIELECTRIC PROPERTIES; ELECTRONICS

10223
(DIAGNOSTICS AND INSTRUMENTATION; INSULATION, MAGNETIC)
(Voltage)

MEASUREMENT OF MAGNETICALLY INSULATED LINE VOLTAGE USING A THOMSON PARABOLA CHARGED PARTICLE ANALYSER

T.D. Stanley and R.W. Stinnett
Sandia Labs, Albuquerque, NM 87115
No. CONF-810325-1, 2p (01/1981).

Availability: SAND-8C-2685C
NTIS

The absence of direct measurements of magnetically insulated line voltage necessitated reliance on inferred voltages based on theoretical calculation and current measurements. This paper presents some of the first measurements of magnetically insulated transmission line peak voltages. These measurements were made on the Sandia National Laboratories HydramITE facility. The peak voltage is measured by observing the energy of negative ions produced at the line cathode and accelerated through the line voltage. The ion energy and the charge-to-mass ratio are measured using the Thomson Parabola mass spectrometry technique. This technique uses parallel E and B fields to deflect the ions. The deflected ions are detected using a microchannel plate coupled to a phosphor screen and photographic film. The Thomson Parabola results are compared to Faraday Cup measurements and to calculated voltages based on current measurements. In addition, the significance of observed positive ions is discussed. (ERA citation 06:017881)

Primary Keywords: Inertial Confinement; Beam Transport; Electric Potential; Ion Beams; Measuring Instruments; Photographic Films; Power Supplies; Thomson Scattering

Secondary Keywords: ERDA/70203; ERDA/700208; NTISDE

10224
(REVIEWS AND CONFERENCES)
(Reviews)

HIGH POWER ELECTRON AND ION BEAM CONFERENCE

J.A. Nation and R.N. Sudan
Cornell University, Ithaca, NY 14850
(01/1977).

Availability: CONF-771035-PI
NTIS

Separate abstracts were prepared for each of the 37 included papers. (ERA citation 04:037945)

Primary Keywords: Electron Beams; Inertial Confinement; Ion Beams; Meetings; Leading Abstract

Secondary Keywords: ERDA/700208; NTISDE

10225
(DIAGNOSTICS AND INSTRUMENTATION)

(Voltage)

HIGH-VOLTAGE PULSE REFLECTION-TYPE ATTENUATORS WITH SUBNANOSECOND RESPONSE

R.J. Thomas
Lawrence Livermore Lab, Livermore, CA 94550
IEEE Transactions On Instrumentation And Measurement, Vol. IM-16, No. 2, pp 146-154 (05/1967)

Significant advances have been achieved in high-voltage pulse attenuation and measurement fidelity by utilizing the principle of traveling-wave reflection at an abrupt impedance mismatch along a transmission line. Such 'reflection-type' attenuators allow practically distortionless attenuation of the signal, independent of voltage level. Their rise-time response and attenuation factor can be known very accurately because they are free from voltage and temperature effects making them especially suited as high-voltage pulse calibration standards. The rise-time response for such attenuators can readily attain 100 ps or less, a practical limit being about 30 ps. 14 Refs.

Primary Keywords: Voltage Attenuation; Transmission Line Impedance Matching; Reflected Wave; Transmitted Wave; Low Distortion; Fast Rise

COPYRIGHT: 1967 IEEE. REPRINTED WITH PERMISSION

10226
(PARTICLE BEAMS, ELECTRON)
(Generation)

INTENSE, NANOSECOND ELECTRON BEAMS

F.M. Charbonnier, J.F. Barbour, J.L. Dyke, W.P. Brewster and F.J. Grundhauser
Field Emission Corp, McMinnville, OR 97128
IEEE Transactions On Nuclear Science, Vol. NS-14, No. 3, pp 789-793 (04/1967).

Pulsed radiation sources of higher intensity and shorter duration are desired to broaden the scope of experimental studies of radiation-induced phenomena. For this purpose, a family of generators has been developed which can produce intense pulsed beams of electrons. The highly reproducible beam is extracted from the accelerating tube through a thin window and can be injected readily into other experimental apparatus. Available pulse durations range from 3 to 50 nanoseconds. The maximum electron energy can be adjusted continuously from 150 to 600 keV, and from 500 keV to 1000 keV, depending on the specific generator. Available peak beam currents range from 1E09 to 1E11 amperes, and the electron output can be varied from 1E11 to 2E15 electrons per pulse. When desired, the output beam can be concentrated magnetically to energy densities in excess of 100 cal/cm², creating shock waves and permitting study of materials under intense transient stress. The basic design concepts, and diagnostic techniques developed or adapted for reliable measurement of the beam characteristics, will be discussed. 0 Refs.

Primary Keywords: E-beam Generation; Marx Generator; Field Emission Diode; Design Considerations

Secondary Keywords: Bremsstrahlung Radiation

COPYRIGHT: 1967 IEEE. REPRINTED WITH PERMISSION

10227

(BREAKDOWN STUDIES)

(Gas, Optical)

INTERACTION OF LASER-INDUCED IONIZATION WITH ELECTRIC FIELDS

J.R. Grein (1), R. Pachacek (1), M. Raleigh (1), I.M. Vitkovitsky (1), R. Schlesinger (2) and J. Hallie (2)
(1) Naval Research Lab, Washington, DC 20375
(2) JAYCOR Inc, Alexandria, VA 22304

13th AIAA Fluid And Dynamics Conference, Snowmass, CO, Paper 8-1380, 6p (07/1981)

New results are discussed concerning the guiding of a discharge channel by laser beam. The authors utilize a Nd-glass laser to guide an electrical discharge over distances up to 2 m. Arcsol breakdown by the laser supplies the guiding mechanism. A wide range of guiding distances and delays are studied. 21 Refs.

Primary Keywords: Laser Discharge Guiding; Nd-glass Laser; 2 m Guiding Distance; Variable Distance; Arcsol Breakdown;

Variable Delay

COPYRIGHT: 1980 AIAA

10232

(SWITCHES, CLOSING)

(Vacuum Gaps, Electrical)

A TRIGGERED VACUUM SPARK-GAP SWITCH

L.Th.M. Orriënsen, C.A.J. Hogenholtz and H.A. Van Der Laan
FDm-Instituut voor Plasma-Fysica, Rijnhuizen, Jutphaas, The Netherlands
Journal Of Scientific Instruments, Vol. 42, pp 659-661 (08/1965).

A vacuum spark-gap switch which is triggered by plasmoids has been operated in a voltage range from 15 kV to below 50 V. Delays of 75-60 nsec and a jitter below 3 nsec have been found in the most suitable polarity. The self-inductance of the switch is about 3.5 mH; the resistance is in the range of 1 million to 11 milliohms.

Primary Keywords: Vacuum Spark Gap; Triatron Configuration; Delay Measurement; Jitter Measurement; Low Inductance; 1 Milliohm Resistance; 50 V-18 kV Operating Range

COPYRIGHT: 1965 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10233

RESEARCH AND DEVELOPMENT ON DC CIRCUIT BREAKERS (FINAL REPORT)

G.A. Hofmann, G.L. La Barbera, N.E. Reed and L.A. Shilong
Hughes Research Labs, Malibu, CA 90265
(02/1977).

Availability: EPRI-EL-379
NTIS

The development of a laboratory prototype of an HVDC circuit breaker and testing of this prototype on the Pacific HV-SWDC Intertie is described. A new design in breaker configuration was implemented and tested. The fundamental difference from previous concepts was the use of separate devices to perform the following breaker functions: carrying the continuous current; interrupting fault or load current; and absorbing energy. A unique electronic interrupter was developed which is capable of interrupting over a thousand amperes against one hundred kilovolts. An ultra-fast, in-line mechanical switch, capable of full opening (1 in.) in 1.6 milliseconds, was developed and tested on a power system. (ERA citation 02:034031)

Primary Keywords: Circuit Breakers; Hvdc Systems; Design; Performance Testing; Research Programs

Secondary Keywords: ERDA/200302; NTISERDAP

10234

A TECHNIQUE FOR MEASURING NON-SQUARE PULSED HIGH VOLTAGES TO +OR- 0.25 PERCENT ACCURACY

J.W. Holm-Henry and T.P.C. Ku
University of California, Los Angeles, CA 90024
Final rept. (02/1972).

Availability: PB-206 686
NTIS

An accurate technique for measuring a wide range of pulsed voltages and currents of large magnitude (kilovolts and amps) and short duration at either low or high repetition rates is described. The technique is accurate for both square and nonsquare pulses. The technique is particularly useful for measuring the J-E characteristics (current density - electric field) of semiconductors at high electric fields. The unknown voltages are matched on a CRO to voltage-divide zener diode limited pulses which are accurately known. The sample circuit and reference pulse circuits are given. (Author)

Primary Keywords: Semiconductors_Electrical Measurement; Tests; Current Density; Electric Field; Electric Potential; Pulse Circuits

10235

(BREAKDOWN STUDIES)

(Gas, Products)

ARC STABILITY OF ELECTRONEGATIVE GASES

J.P. Manion, J.A. Philosophos and M.B. Robinson
Allis-Chalmers, Milwaukee, WI
IEEE Transactions On Electrical Insulation, Vol. EI-2, No. 1, pp 1-10 (04/1967).

The decomposition of electronegative gases in electric discharges was studied to determine relative chemical stabilities and the effect of the discharge on dielectric strength. Rate of disappearance of the parent molecule and variation in dielectric strength with arcing time were determined. Good correlation was noted between atomic composition, molecular complexity and stability of the gases to discharge. In the fluorocarbon series the partial substitution of chlorine for fluorine or an increase in molecular complexity by the introduction of the carbon-carbon bond resulted in decreased discharge stability. The major gaseous product of all fluor- and chlorofluoro-carbons studied was CF₃ which was itself almost unaffected by the discharge. A group of molecules of relatively simple structure was found to possess a unique degree of discharge stability. 18 Refs.

Primary Keywords: Gas Breakdown; Breakdown Products; Several Gases; Prebreakdown Stability vs Molecular Complexity; Fluorocarbon Gases; Simple Gases

COPYRIGHT: 1967 IEEE. REPRINTED WITH PERMISSION

241

10236

MILLIMICROSECOND TRIGGERING OF HIGHVOLTAGE SPARK GAPS
 G.A. Theophanis
 Avco Corp., Wilmington, MA
 No. red-9-TM-59-52, 2p (09/1959).
 Availability: AD-608 984
 NTIS

Pulse transformers are often employed in circuits which are used to trigger spark gaps. There are limitations in the use of this type of generator when a high degree of accuracy is desired. To operate large-area, high-power light sources with Kerr cell shutters for the photography of high-velocity particle impacts, synchronization of the light source and shutter must be accomplished with a jitter of no more than a few millimicroseconds. Pulse requirements and spark-gap conditions for millimicrosecond triggering are defined. Several transformerless, trigger generators are described. One of these has been used to trigger 50-kilovolt spark gaps with jitter times as low as 2 millimicroseconds.

Summary of techniques for synchronizing the firing of spark gaps are given. Several methods for using Kerr cells using accurately triggered spark gaps are also discussed. (Author)

Primary Keywords: TRIGGER CIRCUITS; SYNCHRONIZING SWITCHES; SYNCHRONIZING SWITCHES; TRIGGER CIRCUITS; KERR CELLS; ELECTROMAGNETIC PULSES; TRANSFORMERS; PULSE GENERATORS; HIGH-SPEED PHOTOGRAPHY; SPARKS

Secondary Keywords: SPARK GAP TRIGGER CIRCUITS

10237

THE LEADING-EDGE PRINCIPLE WITH PULSE TRANSFORMERS: REDUCTION OF THE COHERENT RESOLUTION BY A LOW NOISE LEVEL HIGH SPEED PREAMPLIFIER
 W. Michalik
 National Aeronautics and Space Administration, Washington, DC
 Zur Leitung Edgemethode Mit Impulstransformatoren. Erhöhung Der Anreichgeschwindigkeit Durch Eine Rauscharmen Schnellen Vorverstärker No. NASA-TT-F-11930, 11p (10/1968).
 Availability: NS9-10646
 NTIS

Primary Keywords: Preamplifiers; Signal Processing; Transformers; Low Noise; Scintillation Counters

10238

COMBINATION OF PBFA I LINES IN A DISK FEED
 J.T. Crow and G.D. Peterson
 Sandia Labs, Albuquerque, NM 87115
 No. SAND-81-0778C, 6p (01/1981).
 Availability: DE81028213
 NTIS

Sandia National Laboratories Particles Beam Accelerator PBFA I has 36 radially converging magnetically self-insulated triplate transmission lines. Each of these magnetically insulated transmission lines (MITL) has a tapered section at the output which changes the configuration from triplate to triaxial. Some ion diodes proposed for testing on PBFA I are cylindrically symmetric and about 10 cm in diameter and require the combination of the individual PBFA I lines in a triplate disk feed. The combination of many MITL's presents two potential problems. There is the possibility that an early pulse from one line might reflect into nearby lines destroying the magnetic insulation in these lines. A computer simulation of a two-line combination showed serious losses, but the line coupling in this 2-D simulation was significantly different. Another possibility is loss of energy in the regions of zero magnetic field between individual lines at the beginning of the disk feed. An experiment on PBFA I is reported which combined two MITL's into a sector of a disk which showed current losses of 12% or less in the later line for pulse arrival time differences of zero to 200 ns, and no evidence of significant losses in the regions of low magnetic field. (FRA citation 06:032363).

Primary Keywords: Linear Accelerators; Configuration; High voltage Pulse Generators; Kilo Amp Beam Currents; Rev. Range 01-13; Performance; Power Transmission Lines

Secondary Keywords: ERDA/430303; NTIS/DE

10240

(DIAGNOSTICS AND INSTRUMENTATION)

(Current)
 A METHOD FOR MEASURING VERY HIGH SPEED TRANSIENT CURRENTS
 A.M. Zarem and F.P. Marshall
 Naval Ordnance Test Station, Pasadena, CA
 The Review Of Scientific Instruments, Vol. 20, No. 7, pp 133-134 (02/1949).

A deflection coil suitable for use in measuring very high speed transient currents is described. When used with a type 912 cathode-ray tube operated at a 15,000-volt accelerating potential, this coil provided a spot deflection of one inch at approximately 50 amperes of current. A mutual inductance device was constructed to extend the range of measurement of the deflection coil. This device consists of two loops of wire 20 ft in diameter and coaxially positioned with adjustable spacing. The current under study is allowed to flow in one coil and the other coil is connected to the deflection coil. The current under study is allowed to flow in one coil and the other coil is connected to the deflection coil. The current under study is given as an analysis of the transient response of such a circuit, taking into account increased losses caused by the transient skin effect. Accurate design of a transformer and deflection coil system to meet specific requirements is indicated by the analysis. The deflection coil and transformer described herein has excellent response for transients as long as two microseconds in duration. 0 Refs.

Primary Keywords: Current Diagnostic; Cathode Ray Tube; Current Transformer

COPYRIGHT: 1949 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10241

(POWER CONDITIONING)

(Pulse Transformers)
 COMPACT TRANSFORMER BASED ON SECTIONS OF COAXIAL CABLE
 A.N. Meshkov and V.I. Shishke
 Instruments And Experimental Techniques, Vol. 19, No. 5, pp 1440-1442 (10/1976).

Trans. From: Pribyly i Tekhnika Eksperimenta 5, 166-168 (September-October 1976)

The possibility is demonstrated of broadening the passband of the transformer using sections of a coaxial cable. The additional transformer having the opposite construction are designed in the form of coaxial lines in which the space between the outer and inner conductors is filled with ferrite. The shunting lines have a high impedance, as a consequence of which the dimensions of the transformer and the length of the output connections are reduced. This ensures broadening of the passband in the duration of 1.5 nsec and an amplitude of 20 kV for a repetition frequency 2.5 kHz and transformer dimensions 32 x 64 x 70 mm is obtained at the output of an experimental construction with a turns ratio of three. 6 Refs.

Primary Keywords: Pulse Transformer; Stacked Line Transformer; Finite

Leaded Line; 1.5 ns Rise Time

COPYRIGHT: 1976 PLenum Press. REPRINTED WITH PERMISSION

10243

(PULSE GENERATORS; ELECTROMAGNETIC LAUNCHERS)

(Flux Compression Railguns)
 EXPLOSIVE FLUX COMPRESSION GENERATORS FOR RAIL GUN POWER SOURCES
 G.M. Fowler, D.R. Peterson, R.S. Caird, D.J. Erickson, B.L. Freeman and J.C. King
 Los Alamos National Labs, Los Alamos, NM 87545

IEEE Transactions On Magnetics, Vol. MAG-18, No. 1, pp 64-67 (01/1982).

A class of explosive magnetic flux compression generators is described that has been used successfully to power rail guns. A program to increase generator current magnitudes and pulse lengths is outlined. Various generator loss mechanisms are discussed and plans to control some of them are outlined. Included are various modifications of the conventional strip generators that are more resistant to undesirable expansion of generator components from magnetic forces. Finally, an integral rail gun is discussed that has coaxial geometry. Integral rail guns utilize the rails themselves as flux compression generator elements and, under ideal conditions, are theoretically capable of driving projectiles to arbitrarily high velocities. Integral coaxial rail guns should be superior in some regards to their square bore counterparts. 9 Refs.

Primary Keywords: Rail Gun; Coaxial Geometry; Flux Compression Generator; Explosive Driver; Component Integration

COPYRIGHT: 1982 IEEE. REPRINTED WITH PERMISSION

10247

(BREAKDOWN STUDIES)

(Exploding Wires)

LIQUID BEHAVIOR OF EXPLODING WIRES

W.G. Chere
 AFCLR, Bedford, MA 01730

The Physics Of Fluids, Vol. 2, No. 2, pp 230-235 (04/1959).

Experiments were performed to secure evidence of the mechanism during the early stages of a wire explosion. High-speed (0.3 m/cosecond) photographs were taken, using a second exploding wire to backlight the first. The results showed no surface irregularities (unduloids) as frequently postulated for the liquid phase of exploding wires. Instead, the evidence points to a condition of extreme superheating of the liquid, followed by sudden explosive vaporization ("transplosion"). Stria in the ensuing vapor cloud were found to develop after the explosion is complete. 18 Refs.

Primary Keywords: Exploding Wire; Initial Explosion Stage; Photographic Diagnostic; Surface Irregularity; Wire Vaporization

COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10255

(ELECTROMAGNETIC FIELD GENERATION)

(Magnetic)

SURFACE EFFECT IN STRONG MAGNETIC FIELDS. I

G.A. Shnirel'man, Leningrad Polytechnical Institute, Leningrad, USSR
 Soviet Physics-Technical Physics, Vol. 12, No. 3, pp 368-373 (09/1967).
 Trans. From: Zhurnal Tekhnicheskoi Fiziki 37, 513-522 (March 1967).

The current distribution in the skin layer is considered in two particular kinds of magnetic fields—one building up exponentially ($B_{\text{sub}1} \approx t^{\alpha}$), the other changing abruptly. The change in resistivity caused by conductor heating and the subsequent transfer of the current into deeper layers of the conductor is taken into account. An approximate solution is obtained which holds in strong magnetic fields ($B_{\text{sub}1} \gg 10^2 T$). The depth of the skin layer varies according to $x^{\alpha} \approx t^{\alpha}$ in weak fields ($x^{\alpha} \approx t^{\alpha}$) and $x^{\alpha} \approx t^{\alpha+1}$ in strong fields ($x^{\alpha} \approx t^{\alpha+1}$). The current density according to $j \approx t^{-\alpha}$ in weak fields ($\alpha = 1/2$) and $j \approx t^{-\alpha-1}$ in strong fields ($\alpha = 1/2$). The heat content of volume elements of the conductor lying close to its surface is nearly equal to the magnetic-field energy density when $\alpha = 1$. 18 Refs.

Primary Keywords: Magnetic Field Generation; Field Interaction With Conductor; Field Diffusion; Conductor Heating; Current Displacement

COPYRIGHT: 1967 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10255

(BREAKDOWN STUDIES)

(Vacuum, Electrical)

CRITERION FOR VACUUM SPARKING DESIGNED TO INCLUDE BOTH RF AND DC

X. Lopatrick, W.D. University of California, Berkeley CA
 The Review Of Scientific Instruments, Vol. 28, No. 10, pp 824-826 (10/1957).

An empirical relation is presented that describes a boundary between no vacuum sparking and possible vacuum sparking. Metal electrodes and RF or DC voltages are used. The criterion applies to a range of surface gradient, voltage, gap, and frequency that extends over several orders of magnitude. Current due to field emission is considered necessary for sparking, but the addition-energetic ions are required to initiate a cascade process that increases the emitted currents to the point of breakdown. 14 Refs.

Primary Keywords: Vacuum Breakdown; RF Breakdown; DC Breakdown;

Field Emission; Empirical Relation; Variable Voltage; Variable Gap Spacing

COPYRIGHT: 1957 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

- 10259
 (BREAKDOWN STUDIES; PARTICLE BEAMS; ELECTRON)
 (Vacuum, Electrical; Generation)
 FIELDS CURRENTS FROM POINTS
 C.F. Eyring, S.S. Mackeown and R.A. Millikan
 California Institute of Technology, Pasadena, CA
Physical Review, Vol. 31, No. 5, pp 900-909 (05/1928).
 The laws governing the extraction of electrons from metals in high vacua by fields, first developed through experiments with crossed wires, then with fine wire cathodes discharging to cylindrical anodes, have been now found to hold throughout for field currents between points and planes. The theory needed for the quantitative determination of the potential gradients at points is here given, and critical gradients then determined experimentally. The generality of the linear relation between $\log i$ and the reciprocal of field-strength is experimentally established. 11 Refs.
 Primary Keywords: Vacuum Breakdown; Field Emission; Potential Gradient; Crossed Wires; High-cylinder Configuration
 COPYRIGHT: 1928 AMERICAN PHYSICAL SOCIETY, REPRINTED WITH PERMISSION
- 10260
 (BREAKDOWN STUDIES)
 (Vacuum, Electrical)
 INVESTIGATION OF HIGH-VACUUM ELECTRICAL BREAKDOWN
 L.V. Terenbaev and V.G. Kalinin
Soviet Physics-Techical Physics, Vol. 9, No. 4, pp 514-520 (10/1964).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 34, 666-673 (April 1964).
 Some features of high-vacuum electrical breakdown are investigated for different electrode shapes and materials in various vacuum chambers and in ultra-high vacuum in the voltage range 20-300 kV. The pulse coefficients for various pulse shapes and durations from 10^{-7} to 9×10^{-5} sec do not exceed 1.7 as a rule and are independent of distance between electrodes. The delay in the electrical breakdown relative to the instant the voltage is applied may reach several microseconds, but in the majority of cases it is practically absent. 18 Refs.
 Primary Keywords: Vacuum Breakdown; Several Electrode Configurations; Several Electrode Materials; Delay Measurement; Voltage Measurement
 COPYRIGHT: 1964 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10261
 (BREAKDOWN STUDIES; SWITCHES, CLOSING)
 (Vacuum, Electrical; Vacuum Gaps, Electrical)
 MINIMUM ENERGY FOR INITIATION OF ELECTRICAL BREAKDOWN IN VACUUM
 I.N. Slivkov
Soviet Physics-Techical Physics, Vol. 11, No. 6, pp 795-797 (12/1966).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 36, 1082-1086 (June 1966).
 The initiation of vacuum breakdown between electrodes of different materials at voltages up to 120 kV by an auxiliary spark is investigated. The minimum energy required to create a pilot spark capable of initiating vacuum breakdown was measured. For an aluminum cathode the minimum energy is 10^{-6} J. 1 Refs.
 Primary Keywords: Vacuum Breakdown; Different Electrode Materials; 120 kV Gap Voltage; Trigger Spark; Minimum Trigger Energy
 COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10262
 (BREAKDOWN STUDIES)
 (Vacuum, Electrical)
 PHOTOGRAPHIC OBSERVATIONS OF A PREBREAKDOWN DISCHARGE TRANSITION BETWEEN METAL ELECTRODES IN VACUUM
 D.J. DeGroot
 Argonne National Lab, Argonne, IL
Journal Of Applied Physics, Vol. 34, No. 4 (Part 1), pp 919-920 (04/1963).
 Photographic observations were made of the electrode gap between a spherical molybdenum anode and a linear stainless steel cathode at voltages near the breakdown limit. At a discrete voltage, in particular gap, ionized patches of about 1.05 mm in diameter appeared on the anode surface. These ionized areas increased in luminosity and number with voltage until one or more depenetrated into a highly unstable incandescent spot undergoing severe localized heating. Both of these events lead to breakdown at these sites, providing evidence for a complex vacuum breakdown process related to the prebreakdown discharges observed. 7 Refs.
 Primary Keywords: Vacuum Breakdown; Prebreakdown Currents; Spherically Symmetric Gap; Molybdenum Anode; Stainless Steel Cathode; Anode Spots
 COPYRIGHT: 1963 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10264
 (BREAKDOWN STUDIES)
 (Vacuum, Electrical)
 PRE-BREAKDOWN CONDUCTION IN CONTINUOUSLY-PUMPED VACUUM SYSTEMS
 W.K. Mansfield
 Nuclear Engineering Lab, London, UK
British Journal Of Applied Physics, Vol. 11, pp 454-461 (10/1960).
 Measurements have been made under impulse conditions of the coefficients A' , the number of H^{+} ions emitted per 250 keV H^{-} ion, and B' , the number of H^{+} ions emitted per 250 keV H^{-} ion, for metal surfaces covered with the contaminating layers likely to be formed in continuously-pumped high-voltage apparatus. The values obtained for A' are 0.1, 1.1 and 0.56, and for B' 0.53, 0.24 and 0.46 for copper, aluminum and silver, respectively. The product of these coefficients is such as to make very probable the hypothesis that pulse discharge conduction in these systems is due to the regenerative exchange of positive and negative ions of hydrogen. The transient nature of this form of conduction is thought to be due to the charging up of the insulating contaminant. 20 Refs.
 Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Regenerative Ion Exchange; Insulator Charging
 COPYRIGHT: 1960 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10265
 (BREAKDOWN STUDIES)
 (Vacuum, Electrical)
 PREBREAKDOWN CONDUCTION BETWEEN ELECTRODES IN ULTRA-HIGH AND HIGH VACUUM
 L.I. Pivovor and V.I. Gordienko
Soviet Physics-Techical Physics, Vol. 7, No. 10, pp 908-912 (04/1963).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 32, 1230-1236 (October 1962).
 The effect of the surface state of the electrodes on prebreakdown conduction was investigated. It was found that after high-temperature heating of the cathode a steady current appears at voltages much less than the microdischarge initiation voltage. The steady current is assumed to be caused by field emission occurring after the heating of the electrodes and after the action of micro-discharges as a result of vacuum breakdown which leads to the formation of micro-points on the surface of the electrodes. It was also found that after high-temperature heating of the anode the microdischarge initiation voltage is increased and there is a current due to thermionic emission in the electric field. Oxidation of the anode was found to restore the threshold microdischarge voltage. 10 Refs.
 Primary Keywords: Vacuum Breakdown; Prebreakdown Current; Electrode Surface Condition; Cathode Heating; Field Emission; Microprojection
 COPYRIGHT: 1963 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10267
 (PARTICLE BEAMS, ION)
 (Generation)
 SMALL-APERTURE DIAPHRAGMS IN ION-ACCELERATOR TUBES
 L. Cranberg and J.B. Menshik
 Los Alamos National Labs, Los Alamos, NM 87545
Journal Of Applied Physics, Vol. 30, No. 5, pp 708-710 (05/1959).
 An investigation has been made to determine the conditions under which the voltage sustained by a 2-ft length of ion accelerator tube may be made proportional to the length of the tube. It has been found that such linearity may be obtained if the tube is segmented at 4 1/2 in. intervals by diaphragms which are so arranged that no straight path is possible from one end of the tube to the other. No significant deterioration in performance of the tube was observed when axial holes were made in each diaphragm up to 3/4 in. in diameter. The voltage gradient realized on these tests was 60 kv/cm. 6 Refs.
 Primary Keywords: Ion Beam Generation; Voltage Linearity; Diaphragm Voltage Grader; 60 KV/cm Voltage Gradient
 COPYRIGHT: 1959 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10268
 (SWITCHES, OPENING)
 (Mechanical)
 THE BRIDGE STAGE OF ELECTRODE EROSION IN SWITCHING 1000-5000-A CURRENTS IN VACUUM
 V.S. Potakin, V.I. Rakovskii and V.M. Tikhonov
 All-Union Institute, Moscow, USSR
Soviet Physics-Techical Physics, Vol. 10, No. 10, pp 1424-1427 (04/1966).
 Trans. From: *Zhurnal Tekhnicheskoi Fiziki* 35, 1848-1852 (October 1965).
 When an electric current is switched off by separating electrodes the entire current passes through the point of last contact. The Joule heat evolved as a result melts the area of current concentration and as the electrodes are further separated this area is formed into a small molten-metal bridge. The study of the bridge stage is interesting, particularly when the contacts are separated in vacuum, because the resulting vapor cloud creates a medium in which a so-called vacuum arc is formed. None of the presently available publications on the bridge stage of erosion treat the behavior of the bridge at very high currents. For these reasons we have studied the bridge stage of erosion that arises when large currents are switched in vacuum. 6 Refs.
 Primary Keywords: Mechanical Opening Switch; Current Interruption; Molten Metal Bridge; Vacuum Arc; Electrode Erosion; tungsten Electrodes
 COPYRIGHT: 1966 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10270
 (BREAKDOWN STUDIES)
 (Gas, Electrical)
 THE ROLE OF INCLUSIONS AND SURFACE CONTAMINATION ARC INITIATION AT LOW PRESSURES
 J.T. Murray and R.A. Duodale
 Atomic Energy Research Establishment, Harwell, Berkshire, UK
British Journal Of Applied Physics, Vol. 17, pp 1023-1034 (08/1966).
 This paper is concerned with the initiation mechanism of electric arcs in low-pressure gas discharge apparatus. It is demonstrated experimentally that arcs are initiated at the sites of inclusions in the surfaces of metal cathode probes exposed to a hydrogen plasma. The presence of relatively volatile extraneous contamination is also necessary, however, for arc initiation to occur under the present experimental conditions (hydrogen ion current density $10 \text{ A}/\text{cu.cm.}$, electric field $10^5 \text{ V}/\text{cm}$). A mechanism for arc initiation involving the production of bursts of cathodic vapour is postulated, in which an essential event is the dielectric breakdown of insulating inclusions. 22 Refs.
 Primary Keywords: Gas Breakdown; Low Gas Pressures; Cathode Inclusions; Stainless Steel Cathode; Arc Initiation
 COPYRIGHT: 1966 THE INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION
- 10271
 (BREAKDOWN STUDIES)
 (Exploding Wires)
 THE SPECTRAL ENERGY DISTRIBUTION AND OPACITY OF WIRE EXPLOSION VAPORS
 J.A. Anderson
 Carnegie Mellon University, Pittsburgh PA 15213
Proceedings Of The National Academy Of Sciences Of The U.S.A., Vol. 8, No. 7, pp 231-232 (07/1972).
 This paper presents results of a study of the spectra of exploding wires. It is found that a wire exploded between two planes emits a continuous spectrum and the absorption lines of the metal vapor can be studied. Spectra of copper, silver, gold, magnesium, zinc, cadmium, aluminum, tin, lead, tungsten, iron and nickel wires are studied. 3 Refs.
 Primary Keywords: Exploding Wires; Absorption Spectrum; Several Wire Metal Calculation
 COPYRIGHT: 1972 GORDON AND BREACH, SCIENCE PUBLISHERS, LTD.

10272
(SWITCHES; CLOSING)

(Vacuum Gaps; Electrical)

A LOW-INDUCTANCE CONTROLLED VACUUM SPARK GAP OPERATING AT A VOLTAGE OF 100 KV AND CURRENT OF UP TO 1.5 MA
V.B. Ikonnikov, G.A. Kicheva and P.I. Shkurope
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 18, No. 6, pp 1798-1800
(12/1975).

Trans. From: Pribory i Tekhnika Eksperimenta 6, 114-116
(November-December 1975)

The construction and characteristics of a low-inductance (15 nH) controlled vacuum spark gap with a working voltage of 1-100 kV is described which commutes currents of up to 1.5 MA. The spark gap has a controllability range 1-100 kV, short actuation time delays 1-0.2 microseconds, and small values of time-delayed scatter. 9 Refs.
Primary Keywords: Vacuum Spark Gap; 1-100 kV Operating Voltage; 1.5 MA Operating Current; Low Jitter; Three Main Electrodes
COPYRIGHT: 1976 PLENUM PRESS, REPRINTED WITH PERMISSION

10273

(ENERGY STORAGE; INDUCTIVE; ENERGY STORAGE; CAPACITIVE; SWITCHES;
OPENING)

(Systems; Capacitor Banks; Explosive Fuses)
INDUCTIVE STORE PULSE COMPRESSION SYSTEM FOR DRIVING HIGH SPEED PLASMA
IMPROLATIONS

R.E. Reinovsky, D.L. Smith, W.L. Baker, J.H. Degnan, R.P. Henderson,
R.J. Kohn, D.A. Kloc and N.F. Roderick
AFRL, Kirtland AFB, NM 87117
IEEE Transactions On Plasma Science, Vol. PS-10, No. 2, pp 73-81
(06/1982)

The Air Force Weapons Laboratory has investigated and developed inductive pulse compression techniques with fuse opening switches for driving high speed plasma implosions. Experiments have demonstrated the delivery of 7.5 MA to a 5-nH load in <200 ns from an initial 1.9-MJ 2-microsecond capacitor bank via inductive pulse compression. Circuit considerations dictate the overall energy efficiency while MHD considerations dictate overall implosion stability and thermalization time. Theoretical considerations along with initial experiment results are presented in this paper. 11 Refs.

Primary Keywords: Inductive Energy Store; Explosive Fuse; 7.5 MA Output Current; Capacitive Energy Store; 1.9 MJ Initial Stored Energy; Experiment; Theory
COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

10274

(BREAKDOWN STUDIES; BREAKDOWN STUDIES)

(Gas; Electrical; Gas; Recovery)

SIMILARITY RELATIONS FOR THE ELECTRIC ARC IN FORCED AXIAL FLOW
K. Regnier (1) and D.T. Tuma (2)
(1) Brown Boveri & Co Ltd, Baden, Switzerland
(2) Carnegie Mellon University, Pittsburgh PA 15213
IEEE Transactions On Plasma Science, Vol. PS-9, No. 2, pp 75-79
(06/1981).

The conservation equations of mass, momentum, and energy in different form Ohm's law, and the experimentally determined dependence of the interaction impedance of the arc on current shape are employed to obtain similarity relations for high pressure electric arcs in forced axial flow around current wires. The similarity relations are then applied to assess the validity of laminar and turbulent flow models for the arc by comparing model predictions with experiment. It is found that the laminar flow model quite often predicts arc behavior contrary to experiment, while the turbulent flow model predictions are much more consistent with experiment. Moreover, the similarity relations should also be useful in exploring arc behavior under circumstances not discussed in this work. 12 Refs.

Primary Keywords: Gas Breakdown; High-pressure Arc; Arc Interruption; Axial Flow; Experiment; Theory Conservation Equations; Ohm's Law; Laminar Flow Model; Turbulent Flow Model
COPYRIGHT: 1981 IEEE, REPRINTED WITH PERMISSION

10275

(DIAGNOSTICS AND INSTRUMENTATION)

(Current)

HIGH FREQUENCY ROGOWSKI COIL RESPONSE CHARACTERISTICS
M. Stypar and G. Gerdin
Fusion Studies Lab, Urbana, IL 61801
IEEE Transactions On Plasma Science, Vol. PS-10, No. 1, pp 40-44
(03/1982).

The high frequency response characteristics of differentiating and self-integrating Rogowski coils have been calculated for arbitrary values of the coil terminating resistance assuming Ampere's law to be valid. Effects due to the reactive and resistive terminating impedance are also discussed. When the current in the coil is taken into account in the measurement of the current of a charged particle beam, it is found that an effective rise time is introduced into the self-integrating coil response on the order of $a/\gamma v$, where a is the major radius of the coil, v is the velocity of the beam, and $\gamma = (1 - v^2/c^2)^{1/2}$. 10 Refs.

Primary Keywords: Rogowski Coil; Response Characteristic; Frequency Response; Ampere's Law; Terminating Impedance; Current Transformer

COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

10276

(SWITCHES; OPENING; BREAKDOWN STUDIES)

(Mechanical; Gas; Recovery)

MECHANISM FOR TEMPERATURE DECAY IN THE FREELY RECOVERING GAS BLAST ARC
E. Richiev and D.T. Tuma
Carnegie Mellon University, Pittsburgh PA 15213
IEEE Transactions On Plasma Science, Vol. PS-10, No. 1, pp 2-7
(03/1982).

Energy loss mechanisms for the extinguished gas blast arc channel in free recovery are defined and their comparative magnitudes are explored for both $N_{2}/2$ and $SF_6/6$ gases. The arc channel temperature decay rate is found to follow at least two time constants, one corresponding to the transit time of the channel gas and the other to a later period. In addition, the influence of the gas pressure and of the initial conditions of the arc channel and the surrounding hot gas mantle at current zero on the decay rate of the channel temperature are investigated. 9 Refs.

Primary Keywords: Gas Air Recovery; Gas Blast Arc; Energy Loss; Nitrogen Gas; $N_2/2$; Gas; Arc Channel Temperature; Variable Gas Pressure

COPYRIGHT: 1982 IEEE, REPRINTED WITH PERMISSION

10277

TIME-DEPENDENT ION DIODE PHYSICS AND ION BEAM TRANSPORT IN STABILIZED
PLASMA CHANNELS

F.L. Sandel
JAYCOR Inc, Alexandria, VA 22304
Final rept. 19 Jul 79-30 Apr 80 No. JAYCOR-PSD-200-81-001-FR, 55p
(01/1981).
Availability: AD-A098 888/1
NTIS

This report summarizes work performed by JAYCOR which has led to significant advances in the understanding of ion diode physics as well as new knowledge of the processes of ion beam transport in the stabilized plasma channel systems previously developed by JAYCOR. The report is divided into three sections. Part A is a comprehensive study of the pinch-beam ion diode. This work was expanded considerably beyond the original scope of the contract and includes studies of anode materials, anode plasma behavior, time-dependent ion beam profiles, beam bunching, ion species and beam neutralization. Part B is a detailed analysis of plasma channel transport experiments in which previously unknown ion energy losses were discovered in the ion diode and/or focusing regions. Part C is a collection of abstracts of papers written during the period of this work.

Primary Keywords: Plasma(Physics); Ion Beams; Transport Properties; Charged Particle; Pinch Effect; Diodes; Pulse Generators; Acetates; Vinyl Plastics; Electrical Impedance; Focusing; Shape

Secondary Keywords: Gamble I Pulse Generators; NTISDODXA; NTISDODKA

10278

ABSTRACTS OF THE HYDROGEN THYRATRON SYMPOSIUM (4TH), HELD AT SIGNAL
COPPS ENGINEERING LABORATORY, FORT MONMOUTH, N. J., NOVEMBER 17 AND 18,
1955

ECDM, Fort Monmouth, NJ 07703
(01/1955).
Availability: AD-660 279
NTIS

Contents: Ratings and new concepts in hydrogen thyratron design; A magnetic assist to hydrogen thyratron switch tubes; Method of paralleling switch tubes for pulsed service; Design notes of high power modulators utilizing hydrogen thyratrons types 5968/1756 and VC-1257; Effect of circuit parameters on hydrogen thyratron operating pressures; Contributing factors to hydrogen thyratron jitter; Clipper tube operating parameters in hydrogen thyratron modulators.

Primary Keywords: Thyatrons; Hydrogen; Abstracts; Symposia; Design; Modulators; Performance(Engineering); Clipper Circuits; Electronic Switches; Circuits; Stability; Pulse Modulation

10279

ACCELERATOR TECHNOLOGY PROGRAM. PROGRESS REPORT, APRIL-DECEMBER 1978
E.A. Knapp and R.A. Jameson
Los Alamos National Labs, Los Alamos, NM 87545
(05/1980).

Availability: LA-8350-PR
NTIS

This report presents highlights of activities in the Accelerator Technology (AT) Division from April through December 1978. The report is divided into 10 sections to cover work done by the four groups that make up AT Division (AT-1, AT-2, AT-3, and AT-4). Section I is a brief summary of the whole report. Sections II through VI describe work done by AT-1, the Linac Technology Group. Subjects covered are the Pion Generation for Medical Irradiation Program, the Electron Gun, Final-Section Accelerator, the Supercon rf Amplifier Program, the Electron Linear Accelerator Program, and the Free Electron Laser Program. Section VII covers the Linear Accelerator Beam Dynamics development, and Sec VIII deals with work with the H exp - Ion Source. Most of the work in Secs. VII and VIII was done by AT-2, the Special Projects Group, although work on factors influencing emittance growth was done by MP-9, and results on emittance growth in the new European Council for Nuclear Research (CERN) linac were reported by an AT-DG/MP-9 team. Section IX concerns the Proton Storage Ring Program for which AT-3, the Storage Ring Technology Group, is responsible. Section X describes the Fusion Materials Irradiation Test (FMIT) Program. This work is done by AT-4, which was organized in April 1978 to design and supervise the construction of the FMIT accelerator. The accelerator team is composed of persons from AT-3 and the Hanford Engineering Development Laboratory, Richland, Washington. The

Primary Keywords: Las; Accelerator; Breeders; Accelerator Facilities; Beam Dynamics; Beam Transport; Fmt Linac; Hydrogen Ions 1 Minus; Ion Sources; Lamp Linac; Linear Accelerators; Pion Beams; Proton Beams; Quadrupoles; Research Programs; Rf Systems; Storage Rings

Secondary Keywords: ERDA/430303; NTISDE

10280

AIRCRAFT EMP ISOLATION STUDY

A. Finch, H. Price, F. Cheo, S. Mercer and T. Haft
AFML, Kirtland AFB, NM 87117
Final rept. (07/1980)

Availability: AD-A093 752/2
NTIS

This report presents the results of a preliminary study into methods for electrically isolating the E-48, the EC-135, and the EC-130 aircraft during EMP tests where the aircraft under test is directly driven by a high-voltage pulser.

Primary Keywords: Electronic Aircraft; Electromagnetic Pulses; Breakdown(Electronic Threshold); Test Methods; Electric Arcs; Pulse Generators; High Voltage; Aircraft Equipment; Airframes; Electric Fields; Intensity; Isolation; Dielectrics; Aircraft; Landing Gear

Secondary Keywords: EC-135 Aircraft; EC-130 Aircraft; E-48 Aircraft; Airplane E-48; Airplane EC-135; Airplane EC-130; EMP; NTISDODXA; NTISDODAF

10281

THE POSSIBILITY OF THE USE OF LIQUID DISCHARGERS IN HIGH-VOLTAGE
NANOSECOND PULSE CIRCUITS

G.A. Mesyats and G.A. Vorobjev
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RS)-1511-80, 7p (11/1980).

Availability: AD-A092 820/0
NTIS

No abstract available.

Primary Keywords: Comulators; Oils; Breakdown(Electronic Threshold); Spark Gaps; Pulse Generators; Transistors; USSR

Secondary Keywords: NTISDODXA; NTISFMUR

- 10282** MODELING OF COMPRESSED MAGNETIC FIELD GENERATORS BY EQUIVALENT CIRCUIT APPROACH
M. Jones
Atomic Weapons Research Establishment, Aldermaston, Berkshire, UK
No. AURE-D-21/80, 56 (07/1980).
Availability: AD-A091 933/2
NTIS

An equivalent circuit model is presented for a helical compressed magnetic field generator. The emphasis has been placed on producing a model which has a short computer run time. Magnetic energy losses due to non-linear field diffusion are taken into account, together with the effects of magnetically-induced conductor motion. Examples of the computer code results are given, together with a comparison with experimental data. (Author)

Primary Keywords: Pulse Generators; Magnetic Fields; Electromagnetic Wave Propagation; Equivalent Circuits; Computerized Simulation; Helical Antennas; Pressure Transducers; Energy Conversion; Explosions; Electric Power; Magnet Coils; Input; Experimental Design

Secondary Keywords: Foreign Technology; NTISDDDXA; NTISFNUK

10283 THE ELECTRON BEAM SEMICONDUCTOR (EBS) AMPLIFIER
R.M. True and J.F. Beckdale
ECOM, Fort Monmouth, NJ 07703
Research and development technical rept. No. DELET-TR-80-13, 42p
(07/1980).
Availability: AD-A091 283/2
NTIS

The Electron Beam Semiconductor (EBS) concept has existed for three decades; but only within the last decade has an active, well-defined program been underway to develop devices that can operate as high-power radio frequency(RF) amplifiers, fast risetime switches, and current and voltage pulse amplifiers. This report discusses the test procedures, data and results of reliability testing of RF and video pulse EBS amplifiers at Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey. Also, the experimental analysis of the series-connected diode-t5 device is described in detail. Finally, the report concludes with a discussion of the state-of-the-art of EBS and future trends of the technology. (Author)

Primary Keywords: Semiconductor Diodes; Current Amplifiers; Control; Electron Beams; Radiofrequency Amplifiers; Pulse Amplifiers; Radiofrequency Pulses; State Of The Art; Reliability(Electronics); Life Tests; Test Equipment; Circuit Analysis

Secondary Keywords: NTISDDDXA

10284 DEVICE WHICH TRIGGERS HIGH-VOLT PULSE GENERATOR
I.P. Peker
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RST)-1934-79, 9p (02/1980).
Availability: AD-A090 985/3
NTIS

No abstract available.

Primary Keywords: Pulse Generators; Trigger Circuits; Spark Gaps; High Voltage; Fixed Capacitors; Transistors; USSR

Secondary Keywords: Triatron; NTISDDDXA; NTISFNUK

10285 STAGE GENERATOR CALCULATION
I.T. Venetshev, G.M. Skoromnyi and E.I. Revutskii
Akademika Mauk USSR, Khar'kov Fiziko-Tekhnicheskii Inst.
(01/1979).
Availability: KFTI-79-21
NTIS

An engineering calculation of the cascade generator (CG) is made for the two schemes used widely in accelerating techniques, for the stable and pulse regimes of loading. The order of the CG calculation at stable loading is shown, as well as the calculation order at pulse loading for the example of the calculation of high voltage CG(70V, 0.25 A, 500 μs, 100 Hz). The calculation error is checked at the CG-300 (in operation) and at the low-voltage CG-700 model, and is 1-4% for debt U and about not worse than 6% for other values. (Atomindex citation 11-508840)

Primary Keywords: Linear Accelerators; Accuracy; Design; Dimensions; Electric Conductivity; Electric Potential; High-voltage Pulse Generators; Numerical Solution; Pulses

Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/430300; NTISINIS; NTISFNUK

Distribution Restriction: U.S. SALES ONLY.

10286 ADC DATA ACQUISITION SYSTEM FOR THE ACCELERATOR VICKS1
W. Liebl and M. Martini
Hahn-Meitner Inst., FRG
(07/1979).
Availability: HWI-B-309
NTIS

A data acquisition system for experiments with the heavy ions accelerator VICKS1 uses fast ADCs with high resolution. The modular CAMAC system transfers the desired single events in a 'Single Mode' from the ADCs to the computer, while the desired coincidence events from up to 12 ADCs are transferred in a 'Group Mode'. The undesired events are rejected by hardware. This report describes the 'Single Mode' and the 'Group Mode' together with a data check and group checks, and it describes furthermore an INPUT REGISTER allowing the ADCs to work in both modes simultaneously, as well as a DUAL SHIFT INPUT REGISTER for dual channel measurements in the 'Single Mode'. (Atomindex citation 11-505611)

Primary Keywords: Vicks1; Analog-to-digital Converters; Camac System; Coincidence Circuits; Data Acquisition Systems; Inertial Cyclotrons; Pulse Circuits

Secondary Keywords: IN GERMAN; Foreign Technology; ERDA/430303; NTISINIS; NTISFNGE

Distribution Restriction: U.S. SALES ONLY.

10287 VECTOR-POTENTIAL FLOW IN RELATIVISTIC BEAM DIODES
D.P. Bacon, S.A. Goldstein, R. Lee and G. Cooperstein
Naval Research Lab, Washington, DC 20375
Memorandum rept. No. NRL-MR-4326, 38p (09/1980).
Availability: AD-A089 133/8
NTIS

Analytic theory, numerical simulations and experiments indicate that a combination of a bias current pinch and an ion induced pinch may allow the efficient pinching of electron beams generated in large aspect ratio diodes. In the new diode geometry, electrons flow radially inward along vector-potential field lines which lie close to the anode. As these electrons do not touch the anode, there is no plasma formation and consequent loss of energy to accelerated ions. Entering a region close to the axis in which the anode plasma does not yet exist, these electrons undergo an ion induced pinch to still smaller radii. Since the bulk of the flow occurs along vector-potential field lines, we have coined this new diode the paravector-potential diode. (Author)

Primary Keywords: Electron Guns; Beam Forming; Diodes; Aspect Ratio; High Voltage; Pinch Effect; Relativity Theory; Potential Flow; Vector Analysis; Bias; Pulse Generators

Secondary Keywords: Gamble 2 Pulse Generators; NTISDDDXA

10288 LOW JITTER SPARK GAP SWITCH FOR REPETITIVELY PULSED PARALLEL CAPACITOR BANKS
O.J. Rohwein
Sandia Lab., Albuquerque, NM 87115
No. CONF-800640-2, 8p (01/1980).
Availability: SAND-80-04956C
NTIS

A two-section air insulated spark gap has been developed for switching multi-kilojoule plus-minus charged parallel capacitor banks which operate continuously at pulse rates up to 20 pps. The switch operates with less than 2 ns jitter, recovers its dielectric strength within 2 to 5 ms and has not shown degraded performance in sequential test runs totaling over a million shots. Its estimated life with copper electrodes is > 10 exp. shots. All preliminary tests indicate that the switch is suitable for continuous running multi-kilojoule systems operating to at least 20 pps. (ERA citation 05-029532)

Primary Keywords: Linear Accelerators; Experimental Data; Graphs; Performance; Pulse Generators; Spark Gaps; Switching Circuits

Secondary Keywords: ERDA/430303; NTISDE

10289 SYNCHRONIZING THE START OF 400-KV VOLTAGE PULSE GENERATOR (QIN-400) AND MEASURING CIRCUIT DURING OSCILLOGRAPHING OF SHORT-TERM PROCESSES
M.I. Barash, I.S. Lavover and G.I. Chumakov
FTD, Wright-Patterson AFB, OH
No. FTD-ID(RST)-1860-79, 14p (12/1979).
Availability: AD-A087 879/3
NTIS

No abstract available.

Primary Keywords: Oscilloscopes; Electronic Scanners; Synchronization(Electronics); Translations; USSR

Secondary Keywords: Dual Beam Oscilloscopes; Autostart Registration; NTISDDDXA; NTISFNUK

10290 DEVELOPMENT OF A 50 HZ, 250 KV, 500 MS, 500 KW AVERAGE POWER PULSER
M.T. Buttram
Sandia Lab., Albuquerque, NM 87115
No. CONF-800640-8, 6p (01/1980).
Availability: SAND-80-04910C
NTIS

This paper describes the development of a 50 Hz research pulser with per shot specifications of 250 kV, 300 ns FWHM, 10 kJ. It is designed for burst mode service. The pulser is a two element gun-barrel type pulser forming a network with the parallel Marx generators serving as the second element. This paper will consider the two Marx generators of the first element and will outline the important ongoing developmental areas. (ERA citation 05-029534)

Primary Keywords: Accelerator Facilities; Linear Accelerators; Power Supplies; Pulse Generators; Specifications

Secondary Keywords: ERDA/430303; NTISDE

10291 DESIGN AND CONSTRUCTION OF A PRECISION PULSE GENERATOR
J.C. Robles G
Instituto Politecnico Nacional, Mexico City, Mexico
Thesis (06/1977).
Availability: INIS-mf-4230
NTIS

The design and construction of a pulse generator is considered to simulate in due form and magnitude the pulses obtained in semiconductor detectors of nuclear radiation in a frequency interval to allow its use in testing and calibration of spectrometric systems. A parameter analysis which define the pulse form through the various types of semiconductor detectors is made, with the objective to obtain the most important characteristics of the pulse transmitted by the detector. These are the characteristics: Variable frequency from 0.0124 to 120 Hz, variable amplitude from 0 to 1 V, Integral linearity $\pm 0.25\%$, amplitude stability $-0.031\%/\text{degC}$ exponential going up time and variable according to steps of 5.3, 25, 50, 130 and 275 nsec., decay time constant 200 or 400 μ sec, with output ending at 100 Ωm. According to the results, the stability is less than the established in the design. In order to improve it, an analysis was made in function with the temperature of the components which integrate the circuit that produces the pulse. This analysis allows us to define the specifications related to the components which integrate the circuit that produces the pulse. This analysis allows us to define the specifications related to the components. Finally a compilation was made of the most common applications of the generator in nuclear instrumentation. (Atomindex citation 09-462214)

Primary Keywords: Pulse Generators; Counting Circuits; Design; Pulse Circuits; Pulse Techniques; Semiconductor Detectors

Secondary Keywords: IN SPANISH; ERDA/440300; Mexico; NTISINIS; NTISFNMX

Distribution Restriction: U.S. SALES ONLY.

10292

STABILIZATION OF THE OUTPUTS OF PULSE AMPLIFIERS UTILIZING NON-LINEAR FEEDBACK NETWORKS. APPLICATION TO NUCLEAR SPECTROMETER AMPLIFIERS
 K.L. Henein
 CEA Centre d'Etudes Nucléaires, Saclay, France 92260
 (02/1978).

Availability: CEA-R-4900
 NTIS

In nuclear spectroscopy, baseline instability and random fluctuations at the output of the amplifier create imperfectly solved problems mainly at high counting rates. After a critical examination of current systems, solutions are proposed which surpass existing ones. It is shown that restorers and stabilizers of baselines have their own preferential application. Considering natural limits of results. (Atomindex citation 10-42499)

Primary Keywords: Pulse Amplifiers; Spectrometers; Background Noise;

Feedback; Stability.

Secondary Keywords: In FRENCH; ERDA/440103; NTISINIS; NTISPNFR

Distribution Restriction: U.S. SALES ONLY.

10293

PHYSICAL PRINCIPLES OF AVALANCHE TRANSISTOR PULSE CIRCUITS
 D.J. Hamilton, J. Gibbons and W. Shockley
 Stanford University, Stanford, CA 94305
 Technical rept. No. TR-53, 19p (02/1959).

Availability: AD-213 153/0
 NTIS

No abstract available.

Primary Keywords: Transistors; Circuits; Theory

Secondary Keywords: Avalanche Transistors; NTISDODDXD; NTISDODXDB

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROCINE.

10294

PRODUCTION AND MEASUREMENT OF ULTRAHIGH-SPEED IMPULSES: IMPULSE BREAKDOWN IN THE 1E-9 SEC RANGE OF AIR AT ATMOSPHERIC PRESSURE
 R.C. FLETCHER
 Massachusetts Institute of Technology, Cambridge, MA
 No. tr21tr20, 10p (06/1949).

Availability: AD-070 882/6
 NTIS

No abstract available.

Primary Keywords: Transients; Voltage Dividers; Pulse Generators;

Measurement; Oscillographs; Electric Discharges;

Air Barometric Pressure

Secondary Keywords: NTISDODXD; NTISDODXDB
 Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROCINE.

10295

NANOSECOND PULSE TECHNIQUE FOR MULTIPLE FRONT STUDIES IN SHOCK TUBES
 M.J. Lubin
 Cornell University, Ithaca, NY 14850
 (08/1963).

Availability: AD-932 779/7
 NTIS

A technique for the production of well-defined, precisely timed nanosecond pulses of X-band microwave power is described. A system for the investigation of extremely fast electron density fronts in shock tubes is outlined utilizing the transmitted and reflected pulses generated by this technique. The transmitted and reflected pulses are displayed on a 2000-mc, rastered oscilloscope. (Author)

Primary Keywords: Pulse Generators; Shock Tubes; Shock

Tubes; Instrumentation; Timing Circuits;

Oscilloscopes; Crystal Detectors; X Band; Pulse

Transmitters; Velocity; Waveguides; Periodicals

Secondary Keywords: NTISDODXD; NTISDODXDB
 Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROCINE.

10296

THEORY OF SMALL HELICAL MAGNETIC FLUX COMPRESSION AMPLIFIERS
 O.M. Stuetzer
 Sandia Labs, Albuquerque, NM 87115
 (09/1979)

Availability: SAND-79-1075
 NTIS

A linear theory is presented of closely wound, helical, magnetic flux compression transducers. The theory is based on an equivalent circuit model. Load inductance, load resistance, and eight basic materials and design parameters are taken into account. Capacitances are neglected. It was necessary to introduce two parameters which are not well understood, but it can be proven that varying them causes only minor changes in the results. The primary conclusion reached is that device performance is limited by both flux loss and flux remaining in the generator after compression. (ERA citation 05:002348)

Primary Keywords: Flux Pumps; Pulse Generators; Analytical Solution; Electronic Circuits; Magnetic Compression; Magnetic Flux

Secondary Keywords: ERDA/990000; NTISDE

10297

PARALLEL-PLATE TRANSMISSION LINE TYPE OF EMP SIMULATORS: SYSTEMATIC REVIEW AND RECOMMENDATIONS
 D.V. Giri, T.K. Liu, F.M. Tesche and R.W.P. King
 AFWL, Kirtland AFB, NM 87117
 Final rept. No. DC-FR-1299-4, 166p (05/1980).

Availability: AD-A086 814/1
 NTIS

This report presents various aspects of the two-parallel-plate transmission line type of EMP simulator. Much of the work is the result of research efforts conducted during the last ten decades at Air Force Materiel Laboratory/AFML, Industrial/university as well. The principal features of individual simulator components are discussed. The report also emphasizes that it is imperative to hybridize our understanding of individual components so that we can draw meaningful conclusions of simulator performance as a whole.

Primary Keywords: Electromagnetic Pulses; Electromagnetic Pulse Simulators; Pulse Generators; Simulators; Transmission Lines; Parallel Orientation; Plates; Van De Graaff Generators; Electrical Impedance; Electric Fields

Secondary Keywords: EMP; EMP Generators; Conical Transmission Lines; Marx Generators; Open Structures; Wave Launchers; Corona Rings; Conical Wave Guides; Characteristic Impedance; NTISDODXA; NTISDODAF

10298

COMPRESSED MAGNETIC FLUX AMPLIFIER WITH CAPACITIVE LOAD
 O.M. Stuetzer
 Sandia Labs, Albuquerque, NM 87115
 (03/1980).

Availability: SAND-79-2339
 NTIS

A first-order analysis is presented for a compressed magnetic flux (CMF) electron amplifier working into a load with a capacitive component. Since the purpose of the investigation was to gain a general understanding of the arrangement, a number of approximations and limitations were accepted. The inductance of the transducer varies with time; the inductance/resistance/capacitance (LRC) circuit therefore is parametric and solutions are different for the stable regime (high C), the oscillation regime (low C), and the transition case. Solutions and performance depend strongly on circuit boundary conditions, i.e., energization of the circuit by either an injected current or by an applied capacitor charge. The behavior of current and energy amplification for the various cases are discussed in detail. A number of experiments with small CMF devices showed that the first-order theory presented predicts transducer performance well in the linear regime. (ERA citation 05:023157)

Primary Keywords: Magnetic Compression; Pulse Generators; Analytical Solution; Magnetic Flux; Power Supplies

Secondary Keywords: ERDA/700202; NTISDE

10299

(ELECTROMAGNETIC COMPATIBILITY)
 (Grounding And Shielding)

DESIGNING THE RFI SHIELDED PACKAGE
 A.L. Albin
 Fairchild Space and Defense Systems, Syosset, NY

Electronic Industries, Vol. 29, No. 1, pp 80-83 (01/1965).

The various problems of shielding electronic systems against EMI through shielded enclosures are identified with steps to reduce these paths suggested. Materials are discussed briefly, as are means of filtering necessary penetrations to enclosures. 6 Refs.

Primary Keywords: Shielded Enclosure; EMI Reduction; Joint Construction; Materials Consideration; Penetrations; Power Filtering

COPYRIGHT: 1965 CHILTON CO.

10300

(SWITCHES, OPENING)
 (Explosive Fuses)

A POWERFUL FOIL BREAKER FOR A CURRENT OF 0.5 MA, WHICH ACTUATES IN 5 MICROSECONDS
 L.V. Dubovoi, I.M. Roife, E.V. Seredenko and B.A. Stekol'nikov
 Scientific-Research Institute Of Electro-Physical Equipment, Leningrad,
 USSR

Instruments And Experimental Techniques, Vol. 17, No. 2, pp 421-422
 Trans. From: Pribyr'i i Tekhnika Eksperimenta 1, 107-108 (March-April 1974)

The construction and electrical characteristics of a breaker for a current of up to 0.5 MA are considered; the breaker is based on current heating followed by thermal explosion of a metallic foil in quartz sand. For a time $1/4 \times 50$ microseconds of current rise to the maximum value, actuation of the breaker takes place in approximately 5 microseconds. 2 Refs.

Primary Keywords: Opening Switch; Exploding Foil; Quartz Sand Environment; 5 Microsecond Opening Time; 500 kA Current

COPYRIGHT: 1974 PLenum Press, REPRINTED WITH PERMISSION

10301

(BREAKDOWN STUDIES)
 (Exploding Wires)

ENERGY PARTITION IN THE EXPLODING WIRE PHENOMENA
 F.D. Bennett
 Army Armament Research and Development Command, Aberdeen Proving Ground, MD 21005

The Physics Of Fluids, Vol. 1, No. 6, pp 515-522 (12/1958).

The streak camera and oscillographic circuit damping data are presented for exploding wires carrying initial currents from 3 to 8 mils. A maximum of specific shock-wave energy in the induced flow is found at a wire diameter different from that of a minimum in the total damping time of the circuit. This displacement is shown to be caused by the presence of residual circuit resistance. The proof is based on a critical analysis of optimum damping conditions in the exploding wire circuit. A maximum of apparent energy within the contact surface appears at about the same wire diameter as the minimum of total damping time. Discussion of the implications of the Taylor-Lin similarity theory indicates that lack of similarity of the flow is probably connected with the displacement of the maximum energies associated with shock-wave and contact surface. 6 Refs.

Primary Keywords: Explosions; Wire; Copper Wire; Photographic Diagnostics; Stress; Current; Shock Wave; Wave Damping

COPYRIGHT: 1958 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10305

(BREAKDOWN STUDIES)
 (Exploding Wires)

PRODUCTS FROM THE ELECTRICAL EXPLOSION OF TUNGSTEN AT CURRENTS OF APPROXIMATELY 1E11 A/SQ.M.
 S.V. Lebedev, B.V. Lukin, A.E. Rautbort and A.I. Savvatimskii
 Academy of Sciences of the USSR, Moscow, USSR

High Temperatures, Vol. 1, No. 5, pp 951-952 (10/1969).

Trans. From: Vysokotemperaturnaya Fizika i Temperatura 7, 1020-1021 (September-October 1969).

The products give information on the explosion mechanism for a metal subjected to a large current. The usual view is that the conductor (usually a wire) evaporates and acquires the properties of a gas, but evaporation cannot explain some results, and it has been supposed that the molten wire at $3E10$ A/sq.m. does not evaporate but breaks up into particles whose size is less than the electron mean free path in the metal. More recent results are of interest here, which indicate that explosion of a wire in air or an inert gas produces an aerosol with articles of size around 0.01 micron. The yield of this aerosol is close to 100% if the supply voltage is high enough, and the size spread of the particles is fairly narrow. Unfortunately, the explosions were not fully characterized; in particular, the current and the energy deposited in the metal were not known, nor was it established what stage of the explosion must be attained in order to produce an aerosol. 6 Refs.

Primary Keywords: Explosions; Wire; Tungsten Wire; Aerosol Production; 0.01 Micron Particle Size; 1E11 A/sq.m. Current Density

COPYRIGHT: 1970 PLenum Press, REPRINTED WITH PERMISSION

10306
(BREAKDOWN STUDIES)
(Surface Flashover)

SURFACE BREAKDOWN IN VACUUM ON BARIUM TITANATE
S.P. Bugayev, V.V. Kremnev, Yu.I. Terent'ev, V.G. Shpak and Ya.Ya. Yurik
Tomsk Polytechnic Institute, Tomsk, USSR
Soviet Physics-Technical Physics, Vol. 16, No. 9, pp 1547-1551
(03/1972).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 41, 1958-1962 (September 1971).

Breakdown in vacuum at the surface of a high-permittivity dielectric is studied using high-voltage nanosecond pulse technology, high-speed photography, and observation of the glow spectrum. The discharge is initiated by vaporization of the dielectric under electron bombardment from a cathode. Spectra lines of the dielectric and electrode materials are found in the resulting plasma. The emission edge of the discharge propagates with a velocity of 1E7 cm/sec. The current increases as a result of the charging of a dynamic condenser, one of whose plates is the plasma formed on the surface of the dielectric. 8 Refs.

Primary Keywords: Surface Flashover; High-permittivity Dielectric; Barium Titanate; Photographic Diagnostic; Spectrographic Diagnostic; Discharge Propagation Velocity; Dynamic Capacitor

COPYRIGHT: 1972 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10309
(SWITCHES; CLOSING; BREAKDOWN STUDIES)

X RADIATION OF A NANOSECOND GRAZING DISCHARGE IN A GAS
P.M. Dushkov and S.L. Kulakov
M.I. Kalinin Leningrad Polytechnical Institute, Leningrad, USSR
Soviet Technical Physics Letters, Vol. 5, No. 1, pp 26-27 (01/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 5, 69-73 (January 1979).
The grazing discharge is continuously finding new applications, for example, in high-current switches, pulsed light sources, and high-power gas lasers. The grazing discharge which occurs along the interface between a gaseous dielectric and a thin solid dielectric, one end of which is metallized, typically grows to a considerable length, $L = 5-100$ cm, at a modest discharge voltage. A calculation of the electric field at the head of the discharge shows that both the normal and tangential components of the field with respect to the surface of the dielectric can have values approximately $1E5-1E6$ V/cm as the discharge propagates. These fields correspond to the typical dielectric thickness, of the order of 2 mm, and pulsed voltages of 50-100 kV. In this letter we report the first experimental demonstration that high-energy electrons are present. These electrons are generated at the head of the discharge because of the strong electric fields and the high longitudinal gradients in the discharge channel at the end of the discharge. The presence of these electrons is inferred from the x rays emitted from the grazing discharge. 11 Refs.

Primary Keywords: Grazing Discharge; E-field Calculations; Experiment; High-energy Electron; X-ray Diagnostic

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10310
JOINT ELECTRON BEAM COMMONALITY EXPERIMENTS ON BLACKJACK 3 AND 3 PRIME:
PART I: MACHINE CHARACTERIZATIONS

D.V. Keller, A.J. Hertz, D.A. Rice and J.J. Powe
Ktech Corp., Albuquerque, NM
Final rept. 1 Jan-31 Dec 79 No. KTECH-TR-79-11-PT-1, 240p (12/1979).
Availability: AD-A090 140/5
NTIS

As part of the DNA Commonality program, material stress generation experiments were performed using the pulsed relativistic electron beam from the Maxwell Laboratories' Blackjack 3 and 3 Prime electron beam machines. Materials used were solid aluminum and tantalum, each of sufficient thickness to be opaque to the beams. The induced stress histories were monitored using X-cut quartz gauges, carbon gauges, and laser velocity interferometry. Fluence levels of up to 350 cal/cm² were used, giving deposition of up to 750 eV/g. In the electron beam characterization included measurement of fluences as a function of axial and radial position, exposure to the anodes, analysis of machine performance (voltage, current) to give electron energy spectra, and establishment of mean electron angles of incidence by comparison of Monte Carlo computations with experimental dose-depth measurements. The observed stresses and electron beam parameters are to be analyzed by SRI for comparison with their wave propagation codes. The stress pulse shapes and amplitudes agree well with nominal predictions, except that a high amplitude stress tail was observed on the high dose experiments that produced Ta vapor. (Author)

Primary Keywords: Thermal Stresses; Electron Beams; Tantalum; Aluminum; Bulk Materials; Stress Analysis; Strain Gages; Electromagnetic Pulses; Pulse Generators; Calorimetry; Energy Transfer; Electron Beams

Secondary Keywords: Blackjack Generators; Blackjack 3 Generators; NTISDDDXA; NTISDDOSD

10311
ANALYSIS OF PROTON TRANSPORT EXPERIMENTS

F.C. Young, S.J. Stephanakis, G. Cooperstein, D. Mosher and F.L. Sandel
Naval Research Lab., Washington, DC 20375
Memorandum rept. (09/1980).
Availability: AD-A088 905/5
NTIS

As a part of the NRL light ion beam research program, experiments on the transport of intense pulsed proton beams have been carried out. The NRE GAMBLE II pulser was used to generate proton beams and the measurement of prompt-gamma rays was the primary diagnostic for proton transport. The first sequence of shots was made using a large-diameter (4.5 cm) transport channel with a 2.5 cm diameter aperture. The transport of 1-Mev proton beams with few hundred kiloamperes a distance of one meter with efficiencies approaching 100% was achieved in this channel. A second sequence of shots with a smaller-diameter (1.2 cm) channel with a 1.2-cm diameter aperture was much less efficient in transporting the beam. Analysis of the prompt-gamma measurements to determine proton currents in the transport channel and transport efficiencies is presented in this report.

Primary Keywords: Proton Beams; Transport Properties; Pulse Generators; Focusing; Pinch Effect; Channels; Plasma Diagnostics; Bremsstrahlung; Low Loss; Detectors; Data Reduction; Graphs

Secondary Keywords: Gamble 2 Pulse Generators; Prompt Gamma Rays; NTISDDDXA; NTISNRL

10312
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME IV: TWCP ELECTRON BEAM TESTS
F.A. Sick
Effects Technology Inc., Santa Barbara, CA
Final rept. Jul 77-Dec 78 No. ETI-CR-79-610-VOL-4, 134p (04/1979).
Availability: AD-A088 214/4
NTIS

This volume presents impulse and stress generation data on FM5822A tape wrapped carbon phenolic and 91-LD phenolic resin using the techniques described in Volumes II and III. Preliminary data analysis is presented; however, the final utility of these data needs to be determined through the TWCP Correlation Program. Data were generated at a peak electron energy of approximately 1-Mev and at fluence levels ranging from approximately 70 to 120 cal/cm². By a unique in-situ diagnostic technique, the experimental errors associated with the beam parameters (fluence, peak dose) were approximately halved when compared with prior test programs for this type of facility.

Primary Keywords: Carbon Phenolic Materials; Composite Structures; Tape Wound Construction; Heat Shields; Electron Beams; Pulse Generators; Test Facilities; Impulse Loading; Stress Testing; Measurement; Phenolic Plastics; Hardened Structures; Weapons Effects

Secondary Keywords: NHEP(Nuclear Hardness Evaluation Procedures); Blackjack 3 Generator; NTISDDDXA; NTISDDOSD

10313
TWCP ELECTRON BEAM TESTING PROGRAM: VOLUME I: SUMMARY

F.A. Sick
Effects Technology Inc., Santa Barbara, CA
Final rept. Jul 77-Dec 78 No. ETI-CR-79-610-VOL-1, 72p (04/1979).
Availability: AD-A088 211/0
NTIS

Volume I of four volumes. Summarizes the results of a series of electron beam tests that: (1) characterized the Maxwell Laboratory's Blackjack III pulsed electron beam facility for material response studies related to nuclear weapons effects on reentry vehicle heat-shield materials; (2) developed a set of instrumentation to diagnose the electron beam environment and measure material response to impulse and stress generation; and (3) generated impulse and stress data on FM5822A carbon phenolic and 91-LD phenolic resin materials. The data generated demonstrated the utility of the Blackjack III facility and will be used in a separate program entitled, "TWCP Correlation Program." The instrumentation developed are applicable to these types of tests on a variety of facilities. The environmental diagnostic instrumentation achieved a significant reduction in experimental uncertainties when compared to prior techniques. This program was conducted within the framework of the Nuclear Hardness Evaluation Procedures Program and the concepts developed therein. (Author)

Primary Keywords: Carbon Phenolic Materials; Composite Structures; Tape Wound Construction; Heat Shields; Electron Beams; Pulse Generators; Test Facilities; Impulse Loading; Stress Testing; Measurement; Phenolic Plastics; Hardened Structures; Weapons Effects

Secondary Keywords: NHEP(Nuclear Hardness Evaluation Procedures); Blackjack 3 Generator; NTISDDDXA; NTISDDOSD

10314
FOUR-CHANNEL DELAY GENERATOR MODEL 5740

D. Baumetz and M. Milner
Israel Atomic Energy Commission, Beersheba, Israel
(01/1978).
Availability: NRCN(1B)-J18
NTIS

The 4-channel delay generator model 5740 generates 4-pulse groups in independent channels. The device offers the possibility of controlling both the time intervals between the pulses of a group and the rate of generation of groups. (Atomindex citation 10:433933). Primary Keywords: Pulse Generators; Delay Circuits; Design; Operation Secondary Keywords: IN HEBREW; ERDA/440300; NTISINIS; NTISFNIS Distribution Restriction: U.S. SALES ONLY.

10315
SHAPER-AMPLIFIER FOR DRIFT CHAMBERS

S.G. Basileadze and L. Lekhovnai
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
(01/1978).
Availability: JINR-13-1127
NTIS

A shaper-amplifier for drift chambers differing from the prototypes by higher sensitivity, introduction of input impulse differentiation, lesser power consumption and the number of elements in described. The shaper-amplifier containing four identical channels is built on the basis of the integral scheme of the K500LP16 "differential receiver". The active parameters are the following: input resistance - 300 ohm; threshold - 1.9 mA; inherent "walking" from the current oscillator - 3.8 ns; intake power - 400 mW/channel. (Atomindex citation 10:441924). Primary Keywords: Drift Chambers; Diagrams; Pulse Amplifiers; Pulse Shapers; Specifications

Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/440104; ERDA/440300; NTISINIS; NTISFNUR

Distribution Restriction: U.S. SALES ONLY.

10316
HIGH-VOLTAGE PULSE GENERATOR WITH A PROTECTIVE SOLENOID

V.D. Volodin, N.S. Gligoleva, N.I. Kaminskii, A.T. Matyushin and V.T. Matyushin
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
(01/1977).
Availability: JINR-R-13-10599
NTIS

A pulse generator with a solenoid for protection of condensers from pulse overvoltages is suggested. The protective solenoid is a part of the generator circuit assembly according to the Arkadiev-Marx scheme and it encircles the generator along its length. Besides implementing the basic protective function this solenoid can serve as a moderator with the increased area of heat dissipation in contrast to small surface resistors. The generator is used in the fast system of the JINR 2m streamer chamber and is designed for the output voltage of approximately 600 kV. (Atomindex citation 10:442065). Primary Keywords: High-voltage Pulse Generators; Diagrams; Equivalent Circuits; Solenoids; Specifications

Secondary Keywords: IN RUSSIAN; Foreign Technology; ERDA/440300; NTISINIS; NTISFNUR

Distribution Restriction: U.S. SALES ONLY.

10317 PRELIMINARY RESULTS OF EXPERIMENTS WITH MODERATE POWER REB
V.K. Rokhig, S.K. Iyyengar and K.C. Mittal
Shobha Atomic Research Centre, Bombay, India
(01/1978).
Availability: INIS-mf-4833
NTIS
No abstract available. (Atomindex citation 10:443085)
Primary Keywords: Plasma Heating; Electron Beams; Pulse Circuits;
Pulse Generators; Uses.
Secondary Keywords: Foreign Technology; ERDA/700101; NTISINIS; NTISFNIN
Distribution Restriction: U.S. SALES ONLY.

10318 GENERATION OF HIGH VOLTAGE PULSES FROM INDUCTIVE ENERGY STORES BY THE USE OF EXPLDING WIRES
U. Schwarz
Technische Univ., Braunschweig (Germany, F.R.). Fakultät für
Maschinenbau und Elektrotechnik.
(01/1977).
Availability: MP-23910
NTIS

This thesis presents investigations and considerations on the generation of high voltages from inductive energy stores charged by a dc power supply. For the proposed method of voltage generation storage coils are needed which can bear high voltages. Design criteria for cylindrical coils for the use at room temperature are given, which show that these coils can withstand voltages of several 100 kV even if geometrically designed for high energy content. To minimize the power for charging of such a coil it helps to make the inner ohmic resistance of the power source lower than the ohmic resistance of the coil. The discussion of the feasibility of the proposed system shows that it becomes useful when using a storage coil with a total volume of more than 1 m³ exp 3. Such coils can be built for high voltages and can be charged with a power of some 100 kW to an energy content up in the Mvar-range. Finally two possible applications are described, one with an ohmic load and one with a capacitive load. (ERA citation 04:057003)

Primary Keywords: High-voltage Pulse Generators; Design; Exploding Wires; Feasibility Studies; Induction; Performance; Pulses

Secondary Keywords: IN GERMAN; ERDA/420200; ERDA/420800; Theses; NTISDEP; NTISFNGE

Distribution Restriction: U.S. SALES ONLY.

10319 EXPLOSIVE MHD RESEARCH
S.P. Gill, D.W. Baum, W.L. Shimmin and D. Mukherjee
Artec Associates Inc., Hayward, CA
Final rept. 1 Apr 76-31 Mar 77 No. FR-119, 125p (05/1977).
Availability: AD-A079 551/8
NTIS
Research on dense nonideal plasmas used in explosive MHD pulse power generators is described. Experiments were performed with three types of explosive plasma sources producing a plasma pressure about 10 kbar and a plasma temperature about 5 eV (58,000 K). A literature survey was performed on theoretical methods for predicting the properties of nonideal plasmas, and calculations were performed using some of the models. Encouraging progress was made in reducing a discrepancy between theory and experiment. (Author)
Primary Keywords: Magnetohydrodynamics; Explosive Forming; Plasma Devices; Energy Conversion; Pulse Tubes; Compression; Shock Waves; Experimental Data; Secondary Keywords: Debye Hückel Theory; Chapman Enskog Integrals; NTISDDDXA

10320 CALCULATIONS OF THE PERFORMANCE OF EXPLOSIVE IMPULSE GENERATORS
H.W. McKay and R.M. Schlaug
Army Ammunition Research and Development Command, Aberdeen Proving Ground, MD 21005
Final rept. No. SAI-78-919-LJ, 42p (08/1979).
Availability: AD-A079 408/1
NTIS

Numerical calculations of the performance of explosive impulse generators were performed. The explosive impulse generators were intended to provide the guidance thrust for a fast response missile guidance system. The objective of these calculations was to provide information to help determine whether an explosive impulse generator could be designed to produce the required impulse without generating a stress environment within the vehicle body that could cause damage either to the internal electronics or to the remaining undetonated impulse generators. Several 1D finite difference calculations were performed to analyze various buffering or stress attenuation schemes while at the same time estimating the impulse generated by the explosive thruster systems. The 1D analyses show that it may be possible to design a system with the required features but further analysis involving 2D explosive loading/structural response calculations is required. (Author)
Primary Keywords: High Explosives; PETN; Sheet Explosives; Pulse Generators; Finite Difference Theory; Thrust; Loads/Forces; Numerical Analysis; Shock Waves; Attenuation; Stresses; Guided Missile Components; Structural Response; One Dimensional; Two Dimensional
Secondary Keywords: Impulse Generators; Explosive Loading; Design; Air Gaps; NTISDDDXA; NTISDDDA

10321 SMALL HELICAL FLUX COMPRESSION AMPLIFIERS
J.E. Gover, O.M. Stuetzer and J.L. Johnson
Sandia Labs., Albuquerque, NM 87115
No. CONF-79050-2, 35p (01/1979).
Availability: SAND-79-1084C
NTIS

Small, explosively compressed, magnetic flux transducers with many closely spaced helical turns are investigated theoretically and experimentally. The analysis is limited to linear operation, but takes into account load influence, proximity effects, and switching delays. The latter are due to retarded breakdown in the wire insulation and to the finite decay time of the magnetic field in the wire. More than 150 experiments showed considerable data scatter. Shots which exhibited low clocking and high amplification were in good agreement with the theory. The main conclusion is that device performance is limited not only by flux loss, but by flux remaining in the generator after compression. (ERA citation 04:052370)

Primary Keywords: Amplifiers; Power Supplies; Thermonuclear Reactors; Explosions; Inertial Confinement; Magnet Coils; Magnetic Compression; Magnetic Flux; Pulse Generators; Switches

Secondary Keywords: ERDA/700203; ERDA/700208; NTISDE

10322 GENERATOR OF CURRENT PULSES WITH AN AMPLITUDE OF 1E6 A AND STABILITY OF +OR- 1E-3 AT A REPETITION RATE OF 2 Hz
B.F. Bayanov, A.V. Il'lin V.N. Pekin, A.P. Panov and G.I. Sil'vestrov
FTD, Wright-Patterson AFB, OH
No. FTD-IDCRSIT-011-79, 17p (02/1979).
Trans. From: Uspekhi po Zaryazhennykh Chastits 1, pp 283-286 (1978)
By C.S. Hack
Availability: AD-A075 180/0
NTIS
No abstract available.

Primary Keywords: Pulse Generators; High Power; Pulse Rate; Repetition Rate; Stability; Circuit Analysis; Translations
Secondary Keywords: NTISDDDXA; NTISFNUR

10323 PULSER FOR VERTICALLY POLARIZED DIPOLE FACILITY (VPD-II)
Authors Unknown
AFML, Kirtland AFB, NM 87117
Final rept. No. FIFR-900, 82p (07/1979).
Availability: AD-A074 838/4
NTIS

This report will provide an outline of the pulser system design features and will give an account of both the factory and site acceptance test procedures and results. During the testing periods certain modifications were found to be necessary in order to improve the performance. These modifications are described. Ultimately, a performance limitation was realized when the pulser was operated into the full VPD-II antenna structure, a limitation which could not be removed without a major redesign of the output peaking circuit. This will be discussed in the report summary and some tentative suggestions for a future-upgrading will be offered.

Primary Keywords: Pulse Generators; Electromagnetic Pulse Simulators; Test Equipment; Test Facilities; Dipole Antennas; Systems Engineering; Modification; Acceptance Tests
Secondary Keywords: Marx Generators; NTISDDDXA; NTISDDDAF

10324 VERY FAST, HIGH PEAK-POWER, PLANAR TRIODE AMPLIFIERS FOR DRIVING OPTICAL GATES
M.M. Howland, S.J. Davis and W.L. Gagnon
Lawrence Livermore Lab., Livermore, CA 94550
(06/1979).
Availability: URL-82538
NTIS

Recent extensions of the peak power capabilities of planar triodes have made possible the latter's use as very fast pulse amplifiers, to drive optical gates within high-power Nd-glass laser chains. These devices are switchable between the 12 kV range and the rise times of a few nanoseconds, into metal optical gates that are essentially capacitive loads. This paper describes a simplified procedure for designing these pulse amplifiers. It further outlines the use of bridged-T constant resistance networks to transform load capacitance to pure resistance, independent of frequency. (ERA citation 04:047592)

Primary Keywords: Pulse Amplifiers; Neodymium Lasers; Design; Performance; Power Supplies; Triode Tubes

Secondary Keywords: ERDA/700208; ERDA/700203; Neodymium Glass Lasers; Planer Devices; NTISDE

10325 COMPRESSED MAGNETIC FIELD GENERATOR SYSTEMS MODEL
J.E. Gover
Sandia Labs., Albuquerque, NM 87115
No. CONF-790622-5, 8p (01/1979).
Availability: SAND-79-1204C
NTIS

A model relating the volume of a compressed magnetic field generator pulsed power system to its electrical energy output is developed. This systems model includes energy density and/or power density models of the electronic components and a CMF generator model which has been confirmed experimentally for system output energies up to 5000 J. For a given output energy there exists an optimum selection of the pulsed power components to give an overall minimum system volume. Under optimum conditions the volume of the CMF generator is equal to one-half of the overall system volume and the overall system volume increases with the one-half power of the system's output energy. In an all-electronic system there is a linear relationship between system volume and output energy. (ERA citation 04:047553)

Primary Keywords: Electric Generators; Chemical Explosives; Design; Magnetic Compression; Mathematical Models; Performance; Pulses

Secondary Keywords: ERDA/420200; Generators; Magnetic Fields; Pulse Generators; NTISDE

**10326 (BREAKDOWN STUDIES)
(Grazing Discharge)
MEASUREMENT OF THE GAS TEMPERATURE AND ELECTRON DENSITY IN AN INCOMPLETE GRAZING DISCHARGE**
P.M. Dashuk, A.K. Zinchuk, V.G. Merkulova and E.A. Sergeevkova
M.I. Kalinin Institute of Politechnical Education, Moscow, USSR
Soviet Physics-Technical Physics, Vol. 23, No. 8, pp 913-916 (08/1978).
Trans. From: Zhurnal Tekhnicheskoi Fiziki 48, 1613-1616 (August 1978).

The gas temperature in the channel in the 'incomplete' stage of a grazing discharge in air and SF₆/air is determined from the measured intensity distribution of the components of the resolved rotational structure of the bands of the second positive system of nitrogen over a broad temperature range. The electron density is determined by the Stark broadening of the H alpha line. The equilibrium of a grazing discharge in its incomplete stage is discussed on the basis of these measurements and the Saha equation. 10 Refs.

Primary Keywords: Grazing Discharge; Incomplete Discharge; Nitrogen Gas; Optical Spectroscopy; Saha Equation

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

**10327
(DIAGNOSTICS AND INSTRUMENTATION)
(Voltage)**

A DIVIDER FOR MEASURING NANOSECOND EHT PULSES
Y.M. Arkatov, P.I. Vatset, V.I. Voloshchuk, E.A. Gevrilichev, V.A.
Zolotko and I.M. Prokhorov
Instruments And Experimental Techniques, Vol. 23, No. 1, pp 123-124
(01/1980).
Trans. From: Pribyr i Tekhnika Eksperimenta, No. 1, pp. 125-126
A description is given of a voltage divider in which the low-voltage arm is composed of a planar capacitor and a divider composed of MLI resistors. The divider with a division factor of 4E-3 provides for the transmission of the leading edge of a pulse of duration 1 ns. nanoseconds can be used in the measurement of amplitudes up to 250 kV. 4 Refs.
Primary Keywords: Capacitive Voltage Divider; Resistive Voltage Divider; 250 kV Working Voltage; Nanosecond Rise Time; MLI Resistor
COPYRIGHT: 1980 PLENUM PRESS, REPRINTED WITH PERMISSION

**10328
(PULSE GENERATORS; POWER CONDITIONING)
(Marx Pulse Transformers)**

A HIGH-VOLTAGE PULSE GENERATOR WITH AN EXTENDED ZONE OF STABLE OPERATION
A.P. Konarov, Yu.P. Pichugin and I.N. Romanenko
Chuvash State University, USSR
Instruments And Experimental Techniques, Vol. 24, No. 2, pp 419-421
(04/1981).
Trans. From: Pribyr i Tekhnika Eksperimenta 2, 124-126 (March-April 1981)

A generator of high-voltage pulses in the nanosecond range is described in which the stages of the dischargers are triggered by means of pulse transformers. The amplitude of the output voltage pulse is approximately 100 kV, the rise time is $t_{rise} \approx 1$ ns, and the recurrence rate of the pulses is up to 50 Hz. 6 Refs.
Primary Keywords: Marx Generator; 100 kV Output Voltage; 8 ns Rise Time; Pulse Transformer Triggering; Rep-rated: 50 Hz Repetition Rate
COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

**10329
(BREAKDOWN STUDIES)
(Vacuum, Electrical)**

COMPOSITION OF THE INTERELECTRODE PREBREAKDOWN CURRENT IN HIGH VACUUM
H.C. Bourne Jr.
Massachusetts Institute of Technology, Cambridge, MA
Journal of Applied Physics, Vol. 26, No. 5, pp 625-626 (05/1955).
Thermal rise measurements on vacuum-insulated electrodes subjected to steady gap voltages in the range of 80 to 100 kV show that the interelectrode prebreakdown current is composed chiefly of negatively charged particles. With aluminum electrodes the negative particles outnumber the positive particles (ions) by at least 300 to 1. With steel electrodes, the ratio is greater than 1000 to 1. 2 Refs.
Primary Keywords: Vacuum Breakdown; Prebreakdown Current; DC Voltage; 100 kV Voltage; Charge Carrier Identification
COPYRIGHT: 1955 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**10330
(SWITCHES, CLOSING; SWITCHES, CLOSING)
(Gas Gaps, Electrical; Gas Gaps, Materials)**

GAS MIXTURE N/SUB 2/ + SF/SUB 6/ + Ar FOR A HIGH-PRESSURE DISCHARGER
B.M. Kovalevchuk, V.A. Levinnovich, Yu.F. Pototsyn and V.V. Toplygin
Academy of Sciences of the USSR, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 22, No. 2, pp 434-436
(04/1979).
Trans. From: Pribyr i Tekhnika Eksperimenta 2, 135-137 (March-April 1979)

The influence of the composition of a N/SUB 2/ + SF/SUB 6/ + Ar gas mixture at a pressure of 10 atm. on the commutation characteristic and actuation delay time of an acoustical-channel controllable discharger is investigated. The optimal mixture composition of 80% N/SUB 2/ + 10% SF/SUB 6/ + 10% Ar is found which will assure maximum steepness of the voltage drop at the discharger. The actuation delay time of the discharger as a function of the gas-mixture composition and a comparison between the obtained and computed commutation times are presented for single-channel commutation. 6 Refs.
Primary Keywords: High Pressure Spark Gap; Argon Gas; Nitrogen Gas; SF/SUB 6/ Gas; Gas Mixtures; Optimization; 10 atm Pressure; Delay Measurement; Theory; Experiment
COPYRIGHT: 1979 PLENUM PRESS, REPRINTED WITH PERMISSION

**10331
(ENERGY STORAGE; CAPACITIVE; PULSE GENERATORS)
(Capacitor Banks; Capacitor Banks)**

GENERATION OF UNIPOLAR CURRENT PULSES OF 10 TO 100 KA AMPLITUDE
S.L. Zaitsev, N.N. Nikolskova and G.A. Shneerson
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, No. 5, pp 1146-1151 (10/1965).
Trans. From: Pribyr i Tekhnika Eksperimenta 5, 123-128
(September-October 1965)

The design of a circuit is given which produces a unipolar current pulse by connecting a nonlinear resistance into the discharge circuit of a bank of capacitors with an inductive load. The nonlinear resistance may be one of the commercially produced carbonborum resistors or of the "vylite", "termite" or "tyrite" type. The calculated results make it possible to select for an arbitrary tuned circuit a resistance which assures the generation of a current pulse with a preset loss of its initial amplitude. Results are given of experimental tests conducted with the circuit at current pulses exceeding 100 kA with series and parallel connections of vylite discs. It has been established that vylite discs are capable of prolonged operation at current densities of up to 1 to 1.3 kA/cm². (duration of the pulse is 4 to 6 microseconds), and that to increase their current-carrying capacity they may be connected in parallel. 2 Refs.

Primary Keywords: Capacitor Banks; Unipolar Output; Inductive Load; Nonlinear Resistor; Parallel Resistors; 100 kA Current
COPYRIGHT: 1965 PLENUM PRESS, REPRINTED WITH PERMISSION

**10333
(PULSE GENERATORS; POWER CONDITIONING)
(Trigger; Pulse Forming Lines)**

HIGH-VOLTAGE PULSE GENERATOR FOR A LOW-RESISTANCE LOAD
A.Yu. Ushakov
Leningrad Polytechnical Institute, Leningrad, USSR
Instruments And Experimental Techniques, Vol. 24, No. 4, pp 962-964
(08/1981).
Trans. From: Pribyr i Tekhnika Eksperimenta 4, 151-152 (July-August 1981)

A generator is described for the production of rectangular voltage pulses with an amplitude of 1E2 to 4E3 V in a load of approximately 2 ohm. The unregulated duration of the pulses is 0.25 microseconds and their repetition rate can be varied from 1 to 100 Hz. 1 Refs.
Primary Keywords: Pulse Generators; Pulse Forming Line; Spark Gap Switch; 1 KA Output Current; Life Test
COPYRIGHT: 1982 PLENUM PRESS, REPRINTED WITH PERMISSION

**10334
(PULSE GENERATORS)**

(Max.)
OUTPUT PERFORMANCE OF THE COAXIAL-TYPE MARX GENERATOR CONSISTING OF BaTiO/SUB 3/ SERIES CERAMIC CAPACITORS
T. Ogura (1), F. Kanbara (1), M. Obera (1), T. Fujioke (1), K. Toyoda (2) and S. Nambu (2)
(1) Keio University, Kohoku-ku, Yokohama-shi, Japan
(2) The Institute Of Physical And Chemical Research, Wako-shi, Saitama, Japan
The Review of Scientific Instruments, Vol. 52, No. 2, pp 273-275
(02/1981).

We have theoretically analyzed the output performance of the coaxial-type Marx generator consisting of BaTiO/SUB 3/ series ceramic capacitors. In this analysis, the capacitance of the BaTiO/SUB 3/ series ceramic capacitor was considered to be variable with applied voltage. The results were compared with experimental results, and fairly good agreement was obtained. As a result of this analysis, it was clarified that the BaTiO/SUB 3/ series capacitor was not able to store efficiently the electrical energy when charged at high voltages. On the other hand, the SrTiO/SUB 3/ series ceramic capacitor has an almost constant capacitance against applied voltages, so that stored energy may be extracted efficiently. We have quantitatively revealed the superiority of SrTiO/SUB 3/ series ceramic capacitors over BaTiO/SUB 3/ capacitors. 2 Refs.
Primary Keywords: Coaxial Marx Generator; Ceramic Capacitor; Capacitance Variation vs Voltage; Theory; Performance Analysis; Comparison With Experiment
COPYRIGHT: 1981 AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

**10335
(PULSE GENERATORS)**

(Systems)
STEPPED HIGH-VOLTAGE PULSE GENERATOR
Yu.M. Muzovibat'ko, P.A. Demchenko and A.G. Reznichenko
Instruments And Experimental Techniques, Vol. 24, No. 1, pp 127-129
(02/1981).
Trans. From: Pribyr i Tekhnika Eksperimenta 1, 122-124
(January-February 1981)

The generator described in the paper produces stepped high-voltage pulses for sweeping the trajectories of probing beams of atomic particles in plasma. The impulse consists of 10 voltage steps whose maximum duration is 1 msec with a leading edge duration of <1.5 microseconds. The maximum pulse amplitude is 10 kV. The irregularity of the plateau of the last step does not exceed 0.2%. 3 Refs.
Primary Keywords: Stepped Voltage Pulse Generator; 10 Voltage Steps; 1 msec Step Duration; Good Voltage Regulation
COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

**10336
(PULSE GENERATORS)**

(Max.)
250-KV PULSE GENERATOR FOR ELECTRICAL-PULSE TECHNOLOGY
V.I. Kurets
Tomsk Polytechnic Institute, Tomsk, USSR
Instruments And Experimental Techniques, Vol. 24, No. 1, pp 123-124
(02/1981).
Trans. From: Pribyr i Tekhnika Eksperimenta 1, (January-February 1982)
The paper describes the circuit and design of the SIN-250 generator of 250-kV pulsed voltage with adjustable pulse repetition rate of 1 to 10 Hz and a pulse energy of 780 J. The generator is provided with an acoustically insulated discharger reducing the noise level to 60 dB. 3 Refs.
Primary Keywords: SIN-250 Marx Generator; 250 kV Output Voltage; Spark Gap Switch; Compact Design; Rep-rate: 10 Hz Repetition Rate
COPYRIGHT: 1981 PLENUM PRESS, REPRINTED WITH PERMISSION

**10337
(ASSEMBLY AND HANDLING APPARATUS FOR THE EBFA MARX GENERATOR)**

G.E. Steller, G.E. Hiett, I.D. Hamilton, M.F. Aker and G.A. Daniels
Sandia Labs, Albuquerque, NM 87115
(05/1979).

Availability: SAND-78-2239 NTIS

Marx generators, a major slow-pulsed power component in Sandia Laboratories Electron Beam Fusion Accelerator (EBFA), were assembled at a remote facility modified to utilize an assembly-line technique. Due to the size and weight of the various components, as well as the final Marx generator assembly, special handling apparatus was designed. Time and manpower constraints required that this assembly be done in parallel with the construction of the Electron Beam Fusion Facility (EBFF). The completed Marx generators were temporarily stored and then moved from the assembly building to the EBFF using special transportation racks designed specifically for this purpose. (ERA citation 04:049411)

Primary Keywords: Electron Beam Fusion Accelerator; Construction; Design; Mechanical Structures; Power Supplies; Supports

Secondary Keywords: ERDA/700208; ERDA/700293; Marx Generators; NTISDE

10338
HIGH CURRENT PULSER FOR EXPERIMENT NO. 225, NEUTRINO ELECTRON ELASTIC SCATTERING
C. Dalton, G. Krausse and J. Sargent
Los Alamos National Lab., Los Alamos, NM 87545
No. CONF-780622-13, 5p (01/1979).
Availability: LA-UR-79-1571
NTIS

With the advent of low-cost honeycomb extrusions of polypropylene sheets, flash chambers have become very attractive for large nuclear particle detector arrays. This has brought about the need for a pulse power system that will provide high peak currents and low levels of spurious radiation. Each module of 10 flash chambers will require a peak current of 20 kA with a rise time (τ_{10-90} /sub 100 ns) of <50 ns, giving a maximum rate of current rise of 400 kA/ μ s. The pulser output voltage develops 7 kV across a load of 0.36 ohms with a pulse width of 500 ns. The repetition rate will be one per second. The paper describes the development of such a system and the impact of the physical limitations of present component technology on lifetime and pulse fidelity. (ERA citation 04:059073)

Primary Keywords: Pulse Generators; Radiation Detectors; Design; Gas Scintillation Detectors; Neutrino Detection; Power Supplies

Secondary Keywords: ERDA/440101; NTISDE

10339
(ENERGY STORAGE; KINETIC; PARTICLE BEAMS; ELECTRON)
(Electron Rings; Generation)

CONCEPT FOR ENERGY-STORAGE RINGS AT 10-100 MJ

F.S. Feibis and R.O. Hunter Jr.

Western Research Corp., San Diego, CA 92121

Journal Of Applied Physics, Vol. 53, No. 6, pp 3961-3966 (06/1982).
A concept is considered for storing 10-100 MJ of electrical energy in a relatively lightweight and compact device. Energy is stored as electron kinetic energy confined in the vertical betatron field of a toroidal ring. Electrons are injected into a ring at full voltage but low current and low power. The stored electron energy is released on a fast time scale. Synchrotron radiation, wall fields, and instabilities constrain the energy that can be stored in each ring. 13 Refs.

Primary Keywords: Energy Store; Electron Ring; Betatron Concept; Electron Extraction; Design Considerations; Theory

COPYRIGHT: 1982 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10340
(SWITCHES; CLOSING)
(Gas Gaps; Optical)

LASER TRIGGERING OF HIGH-VOLTAGE GAS SWITCHES

J.R. Woodworth, C.A. Frost and J.A. Green

Sandia Labs., Albuquerque, NM 87185

Journal Of Applied Physics, Vol. 53, No. 7, pp 4734-4739 (07/1982).
Two different techniques are discussed for uv-laser triggering of high-voltage gas switches using a KrF laser (248 nm) to create an ionized channel through the dielectric gas in a spark gap. One technique uses an uv laser to induce breakdown in SF₆/sub 6%. For this technique, we present data that demonstrate a jitter of τ_{10-90} = 150 ps for a 0.5-MV switch at 82% of its self-breakdown voltage using a low-divergence KrF laser. The other scheme uses additives to the normal dielectric gas, such as tripropylamine, which are selected to undergo resonant two-step ionization in the uv laser field. 11 Refs. Primary Keywords: Spark Gap; Laser Triggering; KrF Laser; Volume Ionization; 150 ps Jitter; SF₆/sub 6% Gas; Tripropylamine Gas

COPYRIGHT: 1982 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10341
(BREAKDOWN STUDIES)
(Gas; Electrical)

HIGH-CURRENT HIGH-PRESSURE DISCHARGE CHAMBER. I

G.G. Antonov, V.S. Borodin, A.I. Zaitsev and F.G. Rutberg
Soviet Physics-Technical Physics, Vol. 17, No. 10, pp 1680-1683 (04/1973).

Trans. From: Zhurnal Tekhnicheskoi Fiziki 42, 2121-2126 (October 1972)
A high-current high-pressure discharge is investigated. The current, voltage, temperature, and electron density are determined experimentally. After 1E-5 sec a constriction is formed in the discharge channel until the diaphragm opens. The results are discussed. 10 Refs.

Primary Keywords: Gas Discharge; Voltage Measurement; Current Measurement; Temperature Measurement; Electron Density Measurement; Discharge Channel Pinching

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10342
MICROPROCESSOR-CONTROLLED, PROGRAMMABLE RAMP VOLTAGE GENERATOR

J. Hopwood
Sandia Labs., Albuquerque, NM 87115
(11/1978).

Availability: SAND-78-8040

NTIS

A special-purpose voltage generator has been developed for driving the quadrupole mass filter of a residual gas analyzer. The generator is microprocessor-controlled with desired ramping parameters programmed by setting front-panel digital thumb switches. The start voltage, step amplitude, and number of such steps are selectable. A maximum of five start-stop levels may be pre-selected for each program. The ramp voltage is 0 to 10 volts with sweep times from 0.1 to 99.99 seconds. (ERA citation 04:022713)

Primary Keywords: High-Voltage Pulse Generators; Mass Spectrometers; Control Equipment; Microprocessors; Pulse Shapers

Secondary Keywords: ERDA/440300; Sweep Generators; Automatic Control; NTISDE

10343
ANALYSIS OF AN INDUCTIVE ENERGY HIGH PERVEANCE ELECTRON BEAM GENERATOR
H. Werner
EGC, Port Monmouth, NJ 07703
Research and development technical rept. No. DELET-TR-78-31, 11p
(11/1978).
Availability: AD-A065 114/1ST
NTIS

An abstract is available.
Primary Keywords: Pulse Generators; Electron Beams; High Energy; High Voltage

Secondary Keywords: High Perveance; Specific Energy; NTISDODXA

10344
UNIVERSAL PULSE GENERATOR WITH A NANOSECOND FAST RESPONSE
S.G. Besledze
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
(01/1977).
Availability: JINR-13-10622
NTIS

A pulse generator with nanosecond action is described; it is mainly designed for testing and tuning fast electronic devices operating with pulses in the NIM standard. The generator is principally based on integral circuits and has wide functional possibilities. It includes a main pulse channel, a delayed-pulse channel, and an overall output which sums up these signals. In addition to the logic pulse outputs, it includes a linear pulse output with an amplitude smoothly regulated in the range from 0.3 to 6.0 V, it can operate in the self-oscillation mode, in the pulse-series formation mode, in the starting mode, and in the single-start mode. Two generators are placed in a double-width CAMAC cell. The generation frequency is from 3 Hz to 55 MHz, pulse duration from 8 to 320 ns, and pulse front duration 2 ns. (Atomindex citation 09:392512)

Primary Keywords: Pulse Generators; Camac System; Delay Circuits; Diagrams; Integrated Circuits; Mhz Range 01-100; Nuclear Instrument Modules; Performance; Pulse Rise Time; Specifications

Secondary Keywords: IN RUSSIAN; ERDA/440300; USSR; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10345
SYSTEM FOR HIGH-VOLTAGE SUPPLY OF MAGNETOSTRICTION SPARK CHAMBERS IN THE 'PHOTON' FACILITY
Y.S. Anisimov, L.S. Boitsova, A.F. Elishov, Y.V. Zenevskii and A.B. Ivanov
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
(01/1977).
Availability: JINR-13-10570
NTIS

A system of high-voltage supply to 32 1kV = 1kv 2 magnetostriiction spark chambers of the experimental unit "Photon" is described. Thyatrons TGII-500/16 are used as commuting elements. The system ensures smooth and independent control of the amplitude of the high voltage pulse at each chamber. Reduction in the amplitude of high-voltage pulses at the spark chambers does not exceed 1%, and the amplitudes of the pulsed sweeping fields are not affected by the presence of limiting stabilizers in the sweeping field multipliers. (Atomindex citation 09:392421)

Primary Keywords: High voltage Pulse Generators; Wire Spark Chambers; Control Systems; Diagrams; Electric Potential; Performance; Pulse Shapers; Thyatrons

Secondary Keywords: IN RUSSIAN; ERDA/440104; USSR; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10346
STUDY ON THE TGII-500/16 THYRATRON CHARACTERISTICS
Y.S. Anisimov, A.F. Elishov, Y.V. Zenevskii, A.I. Malekhov and B.M. Starchenko
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
(01/1977).
Availability: JINR-13-10569
NTIS

The characteristics of 90 TGII-500/16 carmet theratrons used in the system of high-voltage supply to the magnetostriiction spark chambers of the "Photon" unit have been investigated. The operating mode of the thyatrons with a positive current bias has been chosen, which insures their operation in pulsed mode. The average values of the delay and the front of the high-voltage pulse are 80 and 45 ns, respectively, at a filament voltage of 6.3 V and an average bias current of 4 mA. (Atomindex citation 09:392422)

Primary Keywords: High-voltage Pulse Generators; Wire Spark Chambers; Diagrams; Electric Currents; Performance; Pulse Rise Time; Thyatrons

Secondary Keywords: IN RUSSIAN; ERDA/440105; USSR; NTISINIS; NTISFNUR
Distribution Restriction: U.S. SALES ONLY.

10347
ANNUAL PROGRESS REPORT NUMBER 1, 1 JANUARY THROUGH 31 DECEMBER 1978
Stanford University, Stanford, CA 94305
No. SU-SEL-78-031, 46p (10/1978).
Availability: AD-A064 744/657
NTIS

Contents: Information Systems; Computer Systems; Solid State and Integrated Electronics; Radioscience, and Plasma Physics.
Primary Keywords: Electronics; Digital Computers; Integrated Circuits; Data Processing; Tropospheric Scatter Communications; Single Crystals; Magnetrons; Pulse Generators; Electron Beams; Signal Processing; Aluminum Gallium Arsenide; Transport Properties
Secondary Keywords: NTISDODXA

10348
LOW-RESISTANCE WIDE-BAND LOAD OF KILOAMPERE PULSE GENERATORS

V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).

(01/1976).
Availability: JINR-13-10302
NTIS

The results of studies are given of dissipative loads used in high-power pulse generators. It is shown that in the SHF range loads do not meet broad-band requirements. Made for the electron beam monochromator of a linear induction accelerator low-resistance loads from 0.5 to 8 Ohm operate at a pulse rising time of 10^{-10} to 10^{-12} s, a current amplitude of up to 2 kA, pulse duration of 0.5 to 2 ms, and a pulse repetition frequency of up to 30 Hz. (Atomindex citation 09:398792)

Primary Keywords: High-voltage Pulse Generators; Linear Accelerators; Diagrams; Electric Conductivity; Mhz Range 100-10J0; Performance Testing; Pulse Rise Time; Resistors

Secondary Keywords: IN RUSSIAN; ERDA/450307; USSR; NTISINIS
Distribution Restriction: U.S. SALES ONLY

150

10349 GTI-742 STROKE PULSE GENERATOR MADE IN THE CAMAC STANDARD
Kim Yu Zom and A.P. Kryachko
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1976)
Availability: JINR-10-9800
NTIS

A tactostroke generator (GTI-742) made in CAMAC standard is described. The unit ensures output tact pulses with decade frequency intervals from the internal quartz oscillator and can be used as an external signal frequency divider. The number of decades in the unit is 6. Maximum frequency of the quartz oscillator and external signals is 50 mc. Input and output signals have HCM or TTL levels. (Atomindex citation 09:376718)

Primary Keywords: Pulse Generators; Camac System; Flowsheets; Mhz Range 01-100; Microelectronic Circuits; Performance; Quartz
Secondary Keywords: IN RUSSIAN; ERDA/440300; USSR; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10350 PULSE GENERATOR UTILIZING SUPERCONDUCTING APPARATUS
D.B. Birx
Department of the Navy, Washington, DC
Patent Application No. PAT-APPL-928 218, 12p (07/1981).
Availability: AD-0005 725/7ST
NTIS

High power, phase coherent pulses are generated by superconducting apparatus which includes a superconducting cavity resonator that is pumped by a low power microwave source while being isolated from a load. Switching of the cavity to an emitting mode is accomplished in 5 to 10 nanoseconds by firing a gas discharge tube that acts to couple the cavity to the load while decoupling it from the pumping source. (Author)

Primary Keywords: Patent Applications; Pulse Generators; Cavity Resonators; Superconductivity; Gas Discharges; High Power; Microwave Equipment
Secondary Keywords: NTISGPN
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

10351 REFLEX TRIODE WITH UNIDIRECTIONAL ION FLOW
A. Bromborsky, H.E. Brandt and R.A. Kohs
Harry Diamond Labs, Adelphi, MD 20783
Technical memo. No. HDL-TM-78-22, 13p (10/1978).
Availability: AD-A063 597/95T
NTIS

Experimental results show that the ion beam generated by a simple reflex triode can be made almost totally unidirectional toward the virtual cathode. This flow is accomplished by constructing the triode so that a controlled surface flashover generates plasma on only one side of the dielectric anode foil. (Author)

Primary Keywords: Ionization; Ionizers; Ion Generators; Plasma Generators; Ionization; Surface Properties; Dielectric Films; Foils(Materials); Field Emission; Cathodes(Electron Tubes); Anodes(Electron Tubes)
Secondary Keywords: Reflex Triodes; NTISODDXA

10352 HIGH VOLTAGE NANOSECOND PULSER USING A REPETITIVE SERIES INTERRUPTER
M. Weiner
Department of the Army, Washington, DC
Patent Application No. PAT-APPL-895 421, 11p (04/1987).
Availability: AD-D005 442/95T
NTIS

A pulse generation system using an inductive energy storage technique is described. A high magnitude current flowing in a storage inductor is suddenly halted by means of a repetitive series interrupter device and an accompanying magnetic field coupled control circuit. The resulting high voltage generated causes breakdown across a spark gap and transmission of a high energy pulse to a load. The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefor. (Author)

Primary Keywords: Patent Applications; Pulse Generators; High Voltage; High Energy
Secondary Keywords: Short Pulses; Inductive Energy Storage; NTISGPA
Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF APPLICATION AVAILABLE NTIS.

10353 DEVICE FOR AUTOMATION CONTROL OF THE MEHP-2 MODULATOR OF THE 'KRION' ION SOURCE
V.G. Rudnikov
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1977).
Availability: JINR-9-10395
NTIS

A device is described for automatic power control at the MEHP-2 modulator outlet. The modulator has a maximum power in the pulse of 40 kw and serves to impart power to the electron beam in the "K-ION" electron-ray source of multi-charged ions. The device ensures a remote lead-out and control of powerful pulse systems. (Atomindex citation 09:379490)

Primary Keywords: Ion Sources; Control Systems; Electronic Circuits; High-voltage Pulse Generators
Secondary Keywords: ERDA/440301; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10354 HIGH INTENSITY ELECTRON BEAM PROPAGATION BETWEEN TWO PLANE CONDUCTORS AND ITS IMPLICATIONS FOR COLLECTIVE ION ACCELERATION
H.S. Uhm and H. Kim
University of Maryland, College Park, MD 20742
No. PUB-78-243, 28p (01/1978).
Availability: AD-A059 337/65T
NTIS

This paper examines the properties of a high intensity relativistic electron beam propagating between two grounded plane conductors, with particular emphasis on the implications for collective ion acceleration. The steady-state and time averaged equilibrium properties are obtained analytically, by employing a one-dimensional model. Numerical integration of pulsed-beam propagation is shown to result in an oscillatory state around the time averaged equilibrium solution. Based on this investigation, a model of linear beam collective ion acceleration is presented. It is shown that within a few nanoseconds of acceleration time, the ion kinetic energy can be increased to more than ten times electron energy. (Author)

Primary Keywords: Ion Accelerators; Linear Accelerators; Ion Beams; Electron Beams; Pulse Generators; Electron Energy; Plasmaphysics; Current Density; Constants; Dielectric Properties; Space Charge; Computerized Simulation
Secondary Keywords: NTISODDXA

10355 ROTATING BALL GENERATOR
E. Kunhardt and R. Döllinger
Texas Tech Univ Lubbock Dept of Electrical Engineering
Interim rept. (12/1976).
Availability: AD-A059 265/95T
NTIS

No abstract available.
Primary Keywords: Pulse Generators; Electromechanical Devices; Pulse Rate; Charge Transfer; Reprints
Secondary Keywords: Steel Balls; Rotating Ball Generators; NTISODDXR
Distribution Restriction: AVAILABILITY: PUB. IN THE REVIEW OF SCIENTIFIC INSTRUMENTS, V48 N12 P1676-1677 DEC 77.

10356 STUDY ON THE MAKING OF COCKROFT WALTON HIGH TENSION
S. Hutapea
Gamma Research Centre, Yogyakarta, Indonesia
(01/1976).
Availability: PGOM-L117-76
NTIS

A prototype of a generator is being developed at the GAMA Research Center. Experience in working with some components, high voltage capacitor, column, and potential divider is discussed. High voltage diode, the type which is usually used in television, is used. The tension of the generator is measured by using the high ohmic resistance of 4000 megaohm. The maximum tension can be reached no more than 150000 volts. (Atomindex citation 09:365746)

Primary Keywords: Cockcroft-walton Accelerators; Capacitors; Electric Potential; Fluctuations; Pulse Generators
Secondary Keywords: ERDA/430300; Indonesia; NTISINIS
Distribution Restriction: U.S. SALES ONLY.

10357 SHF IMPULSE GENERATOR
J.R. Andrews and E.E. Baldwin
National Bureau of Standards, Boulder, CO 80302
Final rept. May-Sep 77 No. NBSIR-78-888, 76p (06/1978).
Availability: PB-285 233/35T
NTIS

A super-high-frequency (SHF) impulse generator, designed and built by the National Bureau of Standards, is described in detail. The generator produces three different waveforms. The first is a simple impulse of 1 volt amplitude (3 V option) and 60 ps duration with a useful spectrum (15 dB down) extending from low frequencies out to 9 GHz. The second waveform is a single cycle 5 GHz sine wave (doublet) of 0.8 volts peak-to-peak amplitude (1.6V option). Its useful spectrum extends from 0.5 GHz to 11.7 GHz. The third waveform is an exponentially decaying pulse. Its decay time constant is 12.5 GHz and its rise time constant is 1/4 ns. The peak-to-peak amplitude is 0.8 volts. The useful spectrum extends from 1 GHz to 18 GHz. Primary Keywords: Pulse Generators; Waveform Generators; Superhigh Frequencies
Secondary Keywords: Picoseconds; Time Domain; NTISCOMMBS; NTISODDAF

10358 (ENERGY CONVERSION, ELECTRICAL)
(Charging Circuits)
A SLOW CYCLING FLUX PUMP USING DIGITAL CONTROL
T.F. Droege (1), J.R. Purcell (2) and S.T. Wang (2)
(1) Fermi National Accelerator Lab, Batavia, IL 60510
(2) Argonne National Lab, Argonne, IL 60433
IEEE Transaction on Magnetics, Vol MAG-11, No. 2, pp 580-581 (03/1975).
A slow cycling flux pump has been constructed where operation is controlled by digital logic driving a high power operational amplifier. Hall sensors allow closed loop control of the secondary currents to enable switching the heater driven power cryotrons at the optimum time. Operating efficiency of 87% has been achieved. 2 Refs.
Primary Keywords: Flux Pump; High Power Opamp Control; 87% Operating Efficiency; Superconductivity; Cryotrons; Air Core Transformer
COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

10359 NONLINEAR QUASI-AXIAL LINE FOR SHOCK ELECTROMAGNETIC WAVE PRODUCTION
R.V. Khar'yuzov and V.A. Shvets
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1975).
Availability: JINR-13-8709
NTIS

Results are given as to the manufacture of sharpeners with a low wave-making resistance for forming short electromagnetic waves. Kilovolt-second amplitudes were obtained with input voltage being some kilovolts. Duration of the shock wave front is 1 usec. The sharpeners have been designed for the system of electron beam monochromatization in LIU - 30 linear induction accelerator of IBR - 2 exploratory complex. (Atomindex citation 09:352420)

Primary Keywords: Beam Dynamics; Linear Accelerators; Capacitors; Diagnoses; Electric Currents; Ferrites; High-voltage Pulse Generators
Secondary Keywords: ERDA/430200; USSR; NTISINIS
Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY.

10360

LIGHTWEIGHT LINE PULSER
H.J. Blinchikoff
Westinghouse Defense and Electronic Systems Center Baltimore Md Systems Development Div.
Final technical rept. 1 May 76-1 Dec 77 No. 78-0099, 55p (04/1978).
Availability: AD-A054 286/057 NTIS

This report describes the work performed under contract F36602-76-C-0207 to study, develop, and demonstrate the feasibility of a compact, lightweight, modular, pulse-forming network (PFN). The PFN involved is composed of identical modules and one input module that is optimized for a plateau-top voltage that satisfies the goal of 4 or 0.5 percent. The ripple remains within this limit as modules are added or removed from the PFN to change the pulselength in 2 microsec steps. This four-ripple response is achieved without incorporating mutual inductance into the design; therefore, easing the module tuning and assembly. Mutual inductance has been considered indispensable in PFN's, but it is a roadblock for module construction. Its elimination as a design parameter is the key to realizing the modular PFN. All electrical design goals are satisfied and the size goal was achieved by wide margin. The realized volume energy density of 0.1 joules/cu in³ was the best achievable with off-the-shelf capacitors. The goal of 0.5 joules/cu in³ is not compatible with present state-of-the-art components at these power levels. Included herein are results of the following studies undertaken to satisfy the original contract objectives. Theoretical analysis of distributed and lumped constant lines that can realize the PFN.

Primary Keywords: Pulse Generators; Modules(Electronics); Lightweight; Modulators; Radar Equipment
Secondary Keywords: Lightweight Line Pulser; Pulse Forming Networks; NTISDODDXA

10361

INVERSE DIODE STUDY (FINAL REPORT)
Authors Unknown
Physic International Co. San Leandro, CA 94577
(09/1977)
Availability: PIFR-959 NTIS

The experimental work and resultant data of an inverse diode study program sponsored by US ERDA are reported. The thrust of the effort is demonstration of an inverse diode concept, at greater than 120 kA pulse current, and 10 exp 9 W/cm exp 2 energy density levels, for conversion of relativistic electron beam energy into useful electromagnetic energy. The experiments show that the entire injected electron current can be utilized by the inverse diode and more than 70 percent of the injected beam energy can be extracted to supply a secondary diode of matched impedance. An implication of these findings is that design of a vacuum current function, in which multiple beams can be combined to produce beyond state-of-the-art power and current levels in a secondary load, is feasible. A theoretical calculation of electron scattering through thin foils is appended. (ERA citation 03:025404)

Primary Keywords: Electron Sources; Pulse Generators; Aluminum; Design; Electromagnetic Pulses; Electronics; Feasibility Studies; Foils; Performance Testing; Power Range 100-1000 MW; Research Programs; Scattering; Stainless Steels; Titanium; US ERDA

Secondary Keywords: ERDA/700103; NTISDE

10362

AVALANCHE TRANSISTOR PULSER FOR FAST-GATED OPERATION OF MICRO-CHANNEL PLATE IMAGE-INTENSIFIERS
A. Lundy, J.R. Parker, J.S. Lungford and A.D. Martin
Los Alamos National Labs, Los Alamos, NM 87545
No. CONF-771023-6, 8p (01/1977).
Availability: LA-UR-77-2402 NTIS

Transistors operated in the avalanche mode are employed to generate a 1000 volt 10 to 30 nsec wide pulse with less than 4 nsec rise and fall times. This pulse is resistively attenuated to approximately equal to 270 volts and drives the image intensifier tube which is a load of approximately equal to 200 ohms. To reduce stray inductance, the avalanche transistor chips were assembled on a thick film hybrid substrate. Circuit parameters, operating conditions, and coupling to the microchannel plate image-intensifier (MCP) exp 2 tube are described. To provide dc operating voltages and control of transient voltages on the MCP1 exp 2 tube, a resistance-capacitance network has been developed which (a) provides the MCP1 exp 2 output phosphor at ground, (b) provides programmable gains in "if-stop" steps, and (c) minimizes voltage transients on the MCP1 exp 2 tube. (ERA citation 03:024987)

Primary Keywords: Image Intensifiers; Pulse Generators; Chemical Explosives; Design; Detonations; Logic Circuits; Phosphors; Photocathodes; Resolution; Sensitivity; Switches; Transistors
Secondary Keywords: ERDA/440300; ERDA/450100; Drives(Electronics); NTISCE

10363

AN INVESTIGATION OF THE HOLLOW SPHERICAL CATHODE: PART I. EMISSION MECHANISMS OF HOLLOW SPHERICAL CATHODES; PART II. DEVELOPMENT OF A HIGH LEVEL PULSER
K.R. BRUNN
University of Illinois, Urbana IL
No. SR-10 386p (04/1977).
Availability: AD-117 034/457 NTIS

No abstract available.
Primary Keywords: Cathodes; Pulse Generators; Analysis; Design
Secondary Keywords: NTISDODDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE NO MICROFICHE.

10364

INVESTIGATION OF THE RESISTIVE PHASE IN HIGH POWER GAS SWITCHING (RESEARCH AND DEVELOPMENT REPORT)
R.C. O'Rourke
Science Applications, La Jolla, CA 92017
No. SAI-77-515-1J, 66p (01/1977).
Availability: JCR-137/6 NTIS

A theoretical study was made of the resistive phase in high pressure gas switching with the range of interest being (10 to 50) kV from (1J, 10ns, 100Khz) to (100J, 10 mu sec, 10Hz). The resistive phase was examined as a function of applied field, gap spacing, inductance, gas type and pressure, and electrical nature of the initiating and quenching phases as regards system performance. (e.g., the jitter problem) were examined. The cooling and electrode debris removal effects of the vortex gas flow on the operating characteristics of the system were considered. (ERA citation 03:015695)

Primary Keywords: High-voltage Pulse Generators; Design; Gases; Heat Transfer; High Pressure; Laboratory Equipment; Power Supplies; Pulse Circuits; Simulation; Sparks; Valve; Electronic Circuits

Secondary Keywords: ERDA/420800; NTISDE

10365

PRELIMINARY DESIGN OF A 300 KEV ELECTRON GUN FOR A HIGH POWER CO/SUB 2 LASER AMPLIFIER
J. Katzenstein, R.K. Mosavi, Y. Kohanazadeh and M. Taherzadeh
Atomic Energy Organization of Iran, Tehran, Nuclear Research Center.
No. NRC-76-31, 26p (07/1976).
Availability: AED-45 NTIS

The object of this report is to describe the design of a 300 KeV electron gun which could be constructed at the Nuclear Research Centre of the Atomic Energy Organization of Iran, in Tehran. Included are, the specifications, circuit diagram and many necessary calculations. The design itself was chosen because of its simplicity, so no attempt was made toward an advanced or sophisticated model. However, the basic design, as presented in the report, should satisfy the design requirements of the program. (Atomindex citation 03:031523)

Primary Keywords: Carbon Dioxide lasers; electric Charges; Electron Guns; Kev Range 100-1000; Pulse Generators

Secondary Keywords: ERDA/420300; Iran; NTISINIS

Distribution Restriction: AVAILABLE IN MICROFICHE ONLY. U.S. SALES ONLY

10366

DESIGN AND DEVELOPMENT OF A HIGH-POWER, 500 KV PULSED LINE
A. Nicolas
CEA Centre d'Etudes de Valduc, Is-sur-Tille, France
(09/1977)
Availability: SAND-77-6018 NTIS

A study was made of very high voltage (500 KV) pulse production for 50 ns at half height. A coaxial line was coupled to a Marx generator for obtaining the pulses on an impedance-adapted electron diode. The maximum power obtained was 6.4×10^9 W with a current front in the diode of about 30 ns (80 ns pulse length at half height). (ERA citation 03:012963)

Primary Keywords: High-voltage Pulse Generators; Anodes; Cathodes; Coaxial Cables; Design; Electric Generators; Functional Models; Mathematical Models; Power Supplies; Testing

Secondary Keywords: ERDA/420800; Translations; France; NTISDET
Distribution Restriction: TRANSLATION BY P. NEWMAN OF CEA-R-4733.

10367

PULSED POWER SUPPLY FOR INJECTION BUMP MAGNETS
W.F. Freed
Argonne National Lab, Argonne, IL
(01/1977)
Availability: CONF-770607-4 NTIS

A very precise and relatively inexpensive charging circuit for an energy storage capacitor bank feeds an efficient thyristor-controlled pulse-forming discharge circuit. These circuits, which generate magnet pulses of 300 joules at a rate of 30 per second, are analyzed. (ERA citation 03:007278)

Primary Keywords: Zgs; Beam Bending Magnets; Beam Injection; Capacitors; Electric Discharges; Power Supplies; Pulse Circuits; Stored Energy; Thyristors

Secondary Keywords: ERDA/450302; NTISDE

10368

LONG-DURATION PULSER TO SIMULATE CW OPERATION
G.G. Emert
Harry Diamond Labs, Washington, DC 20438
No. TM64 13, 20p (11/1964).
Availability: AD-653 847/657 NTIS

An electronic switch or pulser has been designed to evaluate crossed-field tubes, such as the HDL-developed Rotatron. Feasibility of the pulser design has been proved in simulating CW operation of the Rotatron. The design concept is based on intermittently operating the tube, so that the beam of the injection gun is turned on and off repeatedly by applying a voltage to the control anode. The Rotatron investigation was made at 60 pps with a duty factor of 10%. Also described is a modified pulser with improved pulse shape. This pulser has performed relatively well as a modulator for plate pulsing a microwave triode oscillator at X-band at 1000 pps and a duty factor of 50%. (Author)

Primary Keywords: Radiofrequency Pulses; Circuits; Electronic Switches; Radiofrequency Pulses; Crossed Field Devices; Electron Beams; Electric Guns; Modulators; X Band; Microwave Oscillators; Pulse Amplifiers; Triodes; Voltage

Secondary Keywords: NTISDODDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE NO MICROFICHE.

252

10369

RESEARCH ON THE PHYSICS OF PULSED MHD GENERATORS
 M.S.J. Jones, V.H. Blackman, R.C. Drumfield, E.W. Evans and C.N. McKinnon
 Mhd Research Inc., Newport Beach, CA
 Final rept., 1 July-30 Sep 63 No. 646, 163p (12/1963).
 Availability: AD-426 448/75T NTIS

Two systems are discussed for producing short pulses of electrical power by MHD principles. The first system is driven by condensed explosives and produces pulses lasting from 1 micro sec to 100 micro sec. The peak power generated to date is 23 kw, with an energy output of 1.75 joules. The conversion efficiency, chemical to electrical, is 1%. High conversion efficiencies can be readily achieved. The second system uses the combustion of aluminum with cesium nitrate as the energy source for a supersonic MHD channel. The measured conductivity of the combustion products was 1000 ohm-m. The highest measured peak power output was 29 watts. The experimental data indicate a large electrode drop which must be overcome before currents can flow in the generator. A favorable scaling potential is indicated. (Author)

Primary Keywords: Magnetohydrodynamics; Pulse Generators; Energy Conversion; Electric Power Production; Shock Waves; Rare Gases; Argon; Explosives; Recording Systems; Combustion; Blasts; Electrodes; Magnetic Fields; Probes (Electromagnetic); Pressure; Magnets

Secondary Keywords: MHD Generators; NTISDODDX Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10370

RESEARCH ON THE PHYSICS OF CONTINUOUS AND PULSED MHD GENERATORS
 M.S.J. Jones, V. Blackman, C. McKinnon, E. Evans and T. Neff
 Mhd Research Inc., Newport Beach, CA
 Semiannual technical rept., no. 2, 1 Jan-30 Jun 63 (08/1963).
 Availability: AD-416 299/65T NTIS

No abstract available.
Primary Keywords: Electric Power Production; Magnetohydrodynamics; Pulse Generators; Explosions; Deflagration; Propellants; Explosives; Shock Waves; Energy Conversion; Explosives; Detonation; Magnetics

Secondary Keywords: Pulsed MHD Generators; NTISDODDX Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10371

PENETRATION OF PULSED ELECTROMAGNETIC WAVES INTO CONDUCTING MEDIA
 L.M. Valiase
 ITT, Nutley, NJ
 No. tr2, 20p (12/1961).
 Availability: AD-326 888/55T NTIS

The distributions of steady state and of transient electromagnetic plane waves at the surface of separation between air and ground (or sea) has been computed. These distributions are important for such applications as underwater and geodetic explorations from points located outside the conducting media; the methods of measurement may be simplified by use of a transmission line analogy, which permits the use of comparison or of substitution methods. In addition, it was shown that if a rectangular pulse d-c magnetic plane wave is transmitted from a point within the conducting medium and received at another point of the same, the system may be used for purposes of ranging or for purposes of communication between transmitting and receiving stations. (Author)

Primary Keywords: Communication Systems; Electromagnetic Radiation; Electromagnetism; Geodony; Sea; Water; Underwater; Air; Alternating Currents; Analysis; Antennas; Antisubmarine Warfare; Detection; Dielectrics; Dipole Antennas; Direct Current; Electric Discharges

Secondary Keywords: NTISDODDX Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED. NOTE: ONLY 35MM MICROFILM IS AVAILABLE. NO MICROFICHE.

10372

(BREAKDOWN STUDIES)
 (Exploding Wires)

ALUMINUM FLUORIDE EXPLoding-WIRE LASER
 W.W. Rice and R.J. Jensen
 Los Alamos National Labs, Los Alamos, NM 87545
 Applied Physics Letters, Vol. 22, No. 2, pp 67-68 (01/1973).
 Intense aluminum fluoride laser pulses in the spectral range 12.5-13.5 μ m were observed when fine aluminum wires were exploded into fluorine gas. The laser oscillation occurred during the expansion phase of the wire explosion. (10 Refs.)

Primary Keywords: Aluminum Wires Exploded In Fluorine Gas; AlF Laser Pulses (12.5-13.5 μ m); F_{sub} 2/ Pressure 12.7-42.6 Torr

COPYRIGHT: 1973 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10373

HYBRID EM METHODS
 I. Katz, D.E. Parks, A. Wilson, J.M. Harvey and M. Rotenberg
 Systems Science and Software, La Jolla, CA 92038
 Tech rept., No. 555-R-76-2376, 78p (05/1977).
 Availability: AD-A039 771/1ST NTIS

This report summarizes a study of hybrid electrostatic-electromagnetic techniques for the calculation of SGEMP generated surface currents. Presented are results using the hybrid SQUID code, a technique to treat the currents in small struts, and a theory of nonreflective boundary conditions for electromagnetic SGEMP codes. (Author)

Primary Keywords: Electromagnetic Pulses; Hybrid Circuits; Pulse Generators; Electrostatic Generators; Electromagnetic Radiation; Electric Current; Struts; Photoelectrons; Artificial Satellites; Motion; Reflection

Secondary Keywords: System Generated Electromagnetic Pulses; Surface Currents; Hybrid Squid Codes; NTISDODXA

10374

THE APPLICATION OF STEEP PULSE CURRENTS TO THE ELECTROHYDRAULIC AND MAGNETIC FORMING OF METALS
 J. Gzywinski, T. Les, R. Malewski and I. Bednarski
 American Meteorological Society, Boston, MA
 No. T-P-3, 20p (04/1966).
 Availability: AD-485 505/25T NTIS

The results of a project carried out by the authors in electrohydraulic and magnetic metal forming are given. The circuits employed, the pulse current generator, and the properties of such circuit components as capacitors, trigger and working gaps, and working coils, are described in detail. The conditions for the generation of shock waves in connection with exploding wire phenomena are given, and the current curves are presented together with calculations of the peak and average dissipated energy. In addition, some examples of aluminum and transformer sheet forming are given. Finally, the design of tubular shunts for the measurement of steep current pulses, their properties, and testing methods are discussed. (Author)

Primary Keywords: Material Forming Metals; Explosive Forming Shock Waves; Electric Currents; Circuits; Hydraulic Equipment; Electromagnetic Fields; Pulse Generators; Electric Discharges; Underwater; Exploding Wires; Aluminum

Secondary Keywords: Translations; NTISDODXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10375

PULSE COMPRESSION TUBES

J.W. Hedley and E.R.J. Wingrove
 General Electric Co, Syracuse, NY 13201
 Quarterly progress rept., no. 5, 1 Jul-30 Sep 68 No. 983-GH-155-5, 12p (01/1967).
 Availability: AD-807 411/45T NTIS

Effort was devoted to finalizing stripline circuits, evaluating vendor items, and adjusting the system to meet the limited funds available. Utilizing the presently available funds will permit the assembly of 16 of the 128 taps originally planned. These 16 taps will be constructed in blocks of 8, as originally planned, to prove the effectiveness of the relay line time-sharing technique. If the performance of the 16-tap unit is satisfactory, the remainder of the system can be readily added when additional funding is available. Design during this quarter was devoted to finalizing a reliable, reproducible coding network and stripline delay trimmer. A preliminary study was made of pre-equalizers, but it is felt that they will not be necessary in the delay chain. All major components required in the 16-tap system have been ordered, including the chain amplifiers. (Author)

Primary Keywords: Pulse Compression; Matched Filters; Broadband; Pulse Generators; Coding; Strip Transmission Lines; Delay Lines; Amplifiers; Circuits

Secondary Keywords: NTISDODXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10376

HIGH POWER MODULATOR (SCR)

W.R. Olson, R.A. Smith, S.J. Gourse, T.P. Nowak and A.M. Knopp
 Westinghouse Electric Corp, Baltimore MD Surface Div
 Interim technical rept., 1 Apr-1 Oct 66 (03/1967).

Availability: AD-813 081/75T NTIS

This report includes the efforts expended on device refinement, circuit design and development of a building for high power modulators utilizing the type 291 flat packed transistor in a series stack configuration. An experimental broadband modulator having a minimum holdoff of 10KV and switching a minimum of 375 amperes has been designed and the preliminary stages of construction are described. The preliminary design of a 65KV modulator using these building blocks as major components is described. (Author)

Primary Keywords: Silicon Controlled Rectifiers; Modulators; Integrated Circuits; Modules(Electronics); Power Manufacturing; Thermal Properties; Pulse Generators

Secondary Keywords: Thyristors; NTISDODXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10377

HIGH POWER PULSE COMPRESSION TECHNIQUES

A.G. Stewart
 Department of the Army, Washington, DC
 Patent No. PAT-APP-631-193, 5p (01/1977).
 Availability: AD-003 946/15T NTIS

A method and apparatus are described for compressing high intensity current pulses and for providing an impedance transformation which increases the magnitude of the current of the pulses. A pulse is injected into a transmission line and after the pulse energy is converted to entirely electrostatic form the transmission line is discharged along the length thereof instead of out the end. The transmission line may be longitudinal, or in the shape of a torus, and the discharging may be either synchronous or asynchronous. The method and apparatus may be useful in compressing deuterium/tritium pellets to the point of nuclear burn. (Author)

Primary Keywords: Pulse Compression; Pulse Generators; High Power; Nuclear Fusion; Deuterium; Tritium; Electric Currents; Nuclear Reactors

Secondary Keywords: PAT-CL-333-20; NTISGPA

Distribution Restriction: AVAILABILITY: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND POSSIBLY, FOR FOREIGN LICENSING; COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D. C. 20231 \$0.50.

10378

A NEW LASER POWER SUPPLY

C. Casen
 Army Missile Command, Redstone Arsenal, AL 35804
 No. RR-TR-64-14, 32p (07/1964).
 Availability: AD-483 724/15T NTIS

The feasibility of a variety of power supply systems which may be pulsed to deliver the required electrical power to a laser flash tube is considered. Recommendations for a special pile-type battery are made, based on its performance superiority for a minimum advance in technology, as compared to the effectiveness of other systems in an assumed advanced state of development. A specific system is recommended to satisfy the requirements of a proposed flash tube. Output power density of the recommended battery is about 250,000 kw per cubic meter while the recoverable stored electrochemical energy is expected to be more than 75 million joules per cubic meter. (Author)

Primary Keywords: Lasers_Energy Conversion; Power Supplies; Pulse Generators; Magnetohydrodynamic Generators; Flash Lamps; Feasibility Studies; Storage Batteries

Secondary Keywords: Flash Lamps; NTISDODXD

Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

253

10379

AN OUTPUT EXPRESSION FOR A DISPERSIVE DELAY PULSE COMPRESSION FILTER UNDER ARBITRARY INPUTS

W.R. Jones
Naval Postgraduate School, Monterey, CA 93940
Master's thesis (05/1966).
Availability: AD-A63 555/95T

NTIS

Pulse compression filters are used extensively in modern radar systems. The nature of output waveforms from dispersive delay pulse compression filters driven by specific matched filters. Waveforms has been studied in great detail for these radar applications. However, little work has been done to generalize these results. This report obtains an expression for the filter output in terms of arbitrary input signals. Several particular input waveforms are analyzed using an ideal filter with assumed specific characteristics. In an attempt to indicate trends, different pulse widths and linear frequency modulation rates are assumed for the pulse shapes chosen. The resulting output envelopes are plotted graphically. (Author)

Primary Keywords: Pulse Compression; Matched Filters; Waveform Generators; Radar Signals; Delay Lines; Integral Transforms; Frequency Modulation; Statistical Processes; Special Functions(Mathematical); Electromagnetic Pulses

Secondary Keywords: Chirp Filters; Dispersive Delay Lines; NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED

10380

ABSORPTION OF LIGHT IN GASES

E.L.I. Sloan and E.L. Kerr
Perkin-Elmer Corp., Norwalk, CT
Final rept. 1 Nov 64-31 Jul 67 No. PE-ER-8884, 61p (07/1967).
Availability: AD-818 134/95T

NTIS

Two methods of measuring optical molecular absorptivities in gases, potentially capable of approaching theoretical sensitivity limits of 10 to the minus 8th power/cm were studied. An acoustic method was pushed experimentally to sensitivity of 10 to the minus 5th power/cm absorptivity. Practical obstacles to further improvement have been found for the acoustic method. The second method, a laser illuminated spectrophotometer, was also investigated. Its performance was much closer to the theoretical limit.

Primary Keywords: Gases; Light Transmission; Light Absorption; Carbon Dioxide; Water Vapor; Atmospheres; Absorption Spectra; Molecular Spectroscopy; Lasers; Pulse Generators; Acoustic Detectors; Heating; Membranes; Resonators; Gas Lasers; Nitrogen; Prisms(Optics); Spectrometers; Spectrophotometers; NTISDODXP

Secondary Keywords: Confocal Resonators; Q-Switching; Raman Lasers; Spectrometers; Spectrophotometers; NTISDODXP
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED

10381

GENERATION OF SHORT DURATION PULSES IN LINEAR MHD GENERATORS

M.S.J. Jones, C.M. McKinnon and V.H. Blackman
Mhd Research Inc., Newport Beach, CA
(01/1964)

Availability: AD-821 933/94T

NTIS

It is demonstrated that short pulses of electrical power can be generated by MHD principles using condensed explosives as the energy source. This work has been particularly successful in that large pulses of power have been obtained with relatively high conversion efficiencies. The scaling of these results to larger sizes to produce systems with greater outputs appears relatively straightforward. Additional work is needed to determine the optimum values for the various parameters, however, the basic principles are well understood and the direction for future work to increase output and efficiency can be clearly outlined.

Primary Keywords: Magnetohydrodynamics; Pulse Generators; Explosive Gases; Magnetohydrodynamics; Sheared Charges; Rdx; Cobium; Ionic Detonations; Velocity; Pressure; Electrical Conductivity

Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10382

GENERATION OF FRACTION OF A TERAWATT PROTON PULSES WITH COAXIAL REFLEX TRICPS

J. Golden, C.A. Kapetanakos, S.J. Nash and S.J. Stephanakis
Naval Research Lab., Washington, DC 20375
Interim rept. No. NRI-MR-5422, 21p (12/1976).

Availability: AD-A033 873/15T

NTIS

Results are reported on the generation of MeV pulsed ion beams at a peak power level in excess of 2×10^6 to the 11th power watts that have an angular divergence of about 3 degrees -6 deg./deg. Such beams can be used in the formation of field reversing proton rings.

Primary Keywords: Proton Beams; Production; Ion Beams; Pulse Generators; Triodes; Nuclear Reactions

Secondary Keywords: NTISDODDN; NTISDODNRL
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10383

10-KV PULSE GENERATOR: PULSE TEST ON AUTODIN FILTER DEMONSTRATES

GENERATOR CAPABILITY

L.J. Elliott, H.H. Kojihara and M.N. Smith
Naval Civil Engineering Lab., Port Hueneme, CA
Final technical rept. 1 Jul 67-30 Jun 68 No. NCEL-TR-596, 39p (09/1968).
Availability: AD-841 152/25T

NTIS

This report describes a newly developed pulse voltage generator which provides up to 10 kv of 2-, 10-, and 100-microsecond pulse voltage. These pulses can be superimposed at any phase angle on the base 60-Hertz power provided to operate the test item. Tests with this generator make feasible a more accurate determination of the pulse response behavior of test items under operating conditions because pulse testing is performed with the test item fully energized. It illustrates the type of information obtainable, test data on radio-frequency interference suppressing AUTODIN power line filter is presented. It was found (1) that this type of filter develops high-frequency oscillatory voltages at the output when the input 60-Hertz power contains a pulse voltage; (2) these oscillatory voltages could be suppressed by placing capacitance across the filter input and output; and (3) filters can be designed to be free of high-frequency oscillatory voltages. (Author)

Primary Keywords: Pulse Generators; Transmission Lines; Low Pass Filters; Transients; Radiofrequency Interference; Electronic Equipment; Failure; Electromagnetic Pulses; Thyristors; Communication Systems; Voltage Diodes

Secondary Keywords: Autodin(Automatic Digital Network); Automatic Digital Networks; Gaussian Filters; Power Lines; NTISDODXA
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10384

THE CAPABILITIES OF ELECTRON BEAM-SEMICONDUCTOR ACTIVE DEVICES

C.B.J. Morris
Stanford University, Stanford, CA 94305
No. TR-472701, 25p (10/1968).
Availability: AD-A63 555/95T

NTIS

Some properties of a class of active elements employing an electron beam to control the output current of a semiconductor device are discussed in this paper. It is shown that the basic beam-semiconductor devices have high gains, fast response and large output capability. Numerical data are given that allow the capabilities of the device to be evaluated in a given application. It is shown that the extreme configurational flexibility of the device may be employed to enhance its basic performance capability as well as to realize unique devices that can rapidly perform complex functions. (Author)

Primary Keywords: Semiconductor Devices; Ionization; Electron Beams; Electron Irradiation; Microwave Amplifiers; Electronic Switches; Gain; Optimization; Response; Pulse Generators; Control Systems

Secondary Keywords: NTISDODXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED

10385

SPARK GAP NANOSECOND PULSE GENERATOR

B.R. Gray
Department of the Air Force, Washington, DC
Patent No. PAT-APP-61 889 (02/1972).
Availability: PATENT-3 444 747

NTIS

An apparatus for generating a short duration higher peak voltage pulse from a basic lower pulse voltage of longer duration. A series of spark gaps are arranged such that the total voltage from the basic long duration pulse is applied to each gap in succession. A delay line with a fixed delay which is equal to the total breakdown time of all the other gaps is connected across each spark gap.

Primary Keywords: Patents; Spark; Gap; Nanosecond; Pulse; Generator

Secondary Keywords: PAT-CL-307-106; NTISGAF
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE

COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 60.50.

10386

RESETTABLE MONOSTABLE PULSE GENERATOR

H.M. Garrahan
National Aeronautics and Space Administration, Washington, DC
Patent No. PAT-APP-756 511, 29p (02/1972).
Availability: PATENT-3 569 744

NTIS

This disclosure describes a resettable monostable pulse generator including a charge storage timing circuit. The charge rundown timing circuit includes a capacitor that is charged to peak value by a random pulse from a constant amplitude pulse source. After being charged, the capacitor immediately starts to discharge toward zero. In addition, an output pulse generator starts to generate an output pulse as soon as the capacitor is charged to its peak value and continues to generate the output pulse until the charge drops to a predetermined level. If a second pulse from the constant amplitude pulse source occurs during this rundown period, the capacitor is again charged to its peak value. This reset pulse prevents termination of the output pulse and recycles the termination time of the output pulse (pulse width) to be measured from the inception of the last reset pulse. Each time a reset pulse occurs during a rundown period, the capacitor is recharged to its peak value; hence, the output pulse can exist for a short or long period of time depending on the occurrence of random reset pulses.

Primary Keywords: Patents; Resettable; Monostable; Pulse; Generator

Secondary Keywords: PAT-CL-307-273; NTISGPNASA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE

COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 60.50.

10387

(BREAKDOWN STUDIES)

(Plasma)

DENSE PLASMA DISCHARGES FOR SOLID-TARGET HEATING

I.M. Vitkovitsky, L.S. Levine, D. Mosher and S.J. Stephanakis
Naval Research Laboratory, Washington, DC
Applied Physics Letters, Vol. 23, No. 1, pp 9-11 (06/1973).

19 Refs.

Primary Keywords: Exploding Wire Discharges; High Current Density Electron Beams; Beam-plasma Interaction; Target Damage And Current Density

COPYRIGHT: 1973 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10388

CONCEPTUAL DESIGN OF AN AUTO-RESONANT ACCELERATOR EXPERIMENT

W.E. Drummond, G.I. Bourianoff, E.P. Corbett, D.E. Hestel and W.W. Rienstra
Austin Research Associates Inc., TX
Final rept. No. ARA-224, 307p (11/1976).
Availability: AD-A033 946/557

NTIS

Conceptual design and specifications for a proof-of-principle Auto-Resonant Accelerator. Have been undertaken. In particular, the pulsed power source and diode configuration, the diode to waveguide transition and compression sections, magnetic field characteristics, phase locking and wave growth requirements, and the method of ion loading and acceleration have been examined. Specifications and conceptual designs for these five areas are presented along with several considerations of overall system requirements. (Author)

Primary Keywords: Ion Accelerators; Cyclotron Resonance; Phase Locked Systems; Electron Beams; High Energy; Stability; Pulse Generators; Radio Fields; Diodes; Magnetic Fields

Secondary Keywords: NTISDODXA

10389

WIDE PULSE LOW PRF PULSE GENERATOR
 R.A. Bonning and R.W. McNeil
 Department of the Air Force, Washington, DC
 Patent No. PAT-APPL-608 824, (10/1971).
 Availability: PATENT-3 611 204
 NTIS

A pulse generator capable of producing wide low PRF pulses having fast rise and fall times is realized by circuits which alternately drive a bistable device. A multivibrator is periodically placed in a first stable state by a unijunction transistor relaxation oscillator having a slow period of oscillation. The multivibrator is returned to its second stable state by a unijunction transistor circuit that is activated by the first stable state voltage condition of the multivibrator. A time delay circuit associated with the unijunction transistor circuit delays actuation of the unijunction transistor and thus establishes the pulse width of the pulse generator.

Primary Keywords: Patents; Pulse; Wide; Pulse; Low; PRF; Pulse; Generator
Secondary Keywords: PAT-CL-351-113; NTISGPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10390

PULSE CIRCUIT FOR RADIA SETS
 R.E. Jehle and D.P. Helm
 Department of the Navy, Washington, DC
 Patent No. PAT-APPL-810 182, (04/1971).
 Availability: PATENT-3 576 440
 NTIS

In a G.M. radia set which has a multivibrator meter circuit having an anode between the bistable switchable elements, a pulse generator for providing a periodic feed through pulse to the G.M. tube. The feed through pulse is added to a tube pulse only when they occur simultaneously, to provide a high amplitude counting pulse for the meter circuit.

Primary Keywords: Patents; Pulse; Circuit; Radia
Secondary Keywords: PAT-CL-250-388; NTISGPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10391

PULSE GENERATOR
 T.W. Pearce, A.K. Hochberg and T.O. Poehler Jr.
 Department of the Navy, Washington, DC
 Patent No. PAT-APPL-689 358, (06/1970).
 Availability: PATENT-3 518 455
 NTIS

A pulse generator for the provision of high-energy short-duration pulses. A capacitor is charged by a DC power source and is made to discharge through a load when a first external pulse triggers a first SCR circuit. When it is desired that the high-energy pulse be turned off, a second and delayed external pulse is caused to trigger a second SCR circuit. When said second SCR circuit is triggered, the energy stored in the capacitor is directed toward a dissipative network and is thereby diverted from the load. The duration of the high-energy pulse can be closely controlled since said duration depends basically upon the delay between the initiation of the first and second external triggering pulses.

Primary Keywords: Patents; Pulse; Generator
Secondary Keywords: PAT-CL-307-265; NTISGPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10392

ELECTRICAL PULSE GENERATORS
 R. Buser, G.K. Soule and R.L. Ross
 Department of the Army, Washington, DC
 Patent No. PAT-APPL-672 658, (03/1970).
 Availability: PATENT-3 500 078
 NTIS

A generator of pulses of high energy level and current wherein a strong magnetic field emanating from a superconducting magnet is interrupted by explosively driving a coil or other electrically conductive member past said magnetic field. One or more load coils in which the high energy pulses are to appear may be driven across the superconductor magnetic field, or a flux displacer can be driven so as to alter suddenly the magnetic field flux from the superconducting magnet passing through a stationary load coil or coils.

Primary Keywords: Patents; Electrical; Pulse; Generators
Secondary Keywords: PAT-CL-310-133; NTISGPA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10393

EXPLOSIVE PULSE GENERATOR
 R.L. Conger and J.H. Johnson
 Department of the Navy, Washington, DC
 Patent No. PAT-APPL-710 968, (12/1969).
 Availability: PATENT-3 484 627
 NTIS

An explosive magnetic flux compressor for producing high current pulses with optimum flux build up and maximum current delivered to the output load. A variable load resistance which initially shorts out the output load, operates to switch current generated in the compressor to the output load as resistance is increased in the variable load resistance from heating due to high current generated in the compressor.

Primary Keywords: Patents; Explosive; Pulse; Generator
Secondary Keywords: PAT-CL-310-10; NTISGPA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10394 **ECIMON PULSE GENERATOR OF THE GROUNDED GRID TYPE EMPLOYING A DELAY LINE STORAGE MEANS**

J.W. Johnson, T.E. Kippert and W.J. Kenier
 Energy Research and Development Administration
 Patent No. PAT-APPL-645 582, (07/1969).
 Availability: PATENT-3 457 517
 NTIS

A high current pulsed electron source including a grounded grid electron gun. A coaxial delay line charged from a voltage source is connected to the cathode of the electron gun via a coaxial mercury-welded switch to provide a nanosecond duration driving pulse therefor. The components of the system are matched in characteristic impedance.

Primary Keywords: Patents; Electron; Pulse; Generator; Grounded; Grid; Employing; Delay; Line; Storage

Secondary Keywords: PAT-CL-328-231; NTISGPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10395 **HIGH VOLTAGE FIELD-REVERSAL PULSE GENERATOR USING A LASER SWITCHING MEANS TO ACTIVATE A FIELD EMISSION X-RAY TUBE**

J.B. Robinson
 Energy Research and Development Administration
 Patent No. PAT-APPL-410 928, (10/1969).
 Availability: PATENT-3 438 604
 NTIS

A fast high voltage, high current pulse generator wherein high voltage on a first insulated elongated conductor situated between second and third similar concentric conductors is switched to an end of the second conductor, providing an electric field reversal and generation of a high voltage, high current pulse at the ends of said second and third conductors.

Primary Keywords: Patents; High; Voltage; Field-Reversal; Pulse; Generator; Laser; Switching; Activate; Field; Emission; X-Ray; Tube

Secondary Keywords: PAT-CL-97-455; NTISGPAEC
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10396 **TRIGGER PULSE CIRCUIT**

W.E. Egan
 Department of the Navy, Washington, DC
 Patent No. PAT-APPL-662 259, (04/1968).
 Availability: PATENT-3 381 146
 NTIS

The patent specification and drawings describe a system for controlling the current to an inductive load by utilizing a silicon controlled rectifier capacitor discharge circuit operating from an A.C. source and having a trigger pulse source and a transient suppressor diode.

Primary Keywords: Patents; Trigger; Pulse; Circuit

Secondary Keywords: PAT-CL-310-255; NTISGPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10397 **FAST PULSE GENERATOR UTILIZING AN ELECTRON BEAM TO CAUSE AN ARC BREAKDOWN ACROSS THE GAP REGION OF A COAXIAL LINE CENTER CONDUCTOR**

Q.A. Kerns
 Energy Research and Development Administration
 Patent No. PAT-APPL-459 484, (12/1967).
 Availability: PATENT-3 360 678
 NTIS

In a fast pulse generator, the combination comprising a coaxial transmission line having an outer and an inner conductor, a first portion of said inner conductor being spaced from the outer conductor and from the remainder of the inner conductor of said line, means producing an electrostatic field between said first portion of said inner conductor and said outer conductor of said coaxial line, and a pulsed electron beam generator directing energized electrons between said first portion of said inner conductor and an adjacent one of said conductors to effect discharge of said electrostatic field.

Primary Keywords: Patents; Fast; Pulse; Generator; Electron; Beam; Cause; Arc; Breakdown; Across; Gap; Region; Coaxial; Line; Center; Conductor

Secondary Keywords: PAT-CL-315-3; NTISGPAEC

Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10398 **PULSE GENERATOR WITH STANDING WAVE ENERGY STORAGE**

W.R. Baker
 Energy Research and Development Administration
 Patent No. PAT-APPL-602 042, (07/1967).
 Availability: PATENT-3 333 203
 NTIS

This invention is an electronic circuit for producing a high power output signal comprising a predetermined number of signal cycles over a precisely defined pulse time period. In the circuit, standing waves are generated in a high 'Q' pulse line from a low power signal generator. The energy stored in the standing waves is discharged by suddenly connecting the line to a matching load.

Primary Keywords: Patents; Pulse; Generator; Standing; Wave; Energy; Storage

Secondary Keywords: PAT-CL-328-59; NTISGPAEC

Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10399

REMOTELY CONTROLLED POWER PULSE GENERATOR

L.L. Morse
Department of the Navy, Washington, DC
Patent No. PAT-APPL-367 096, (08/1966).
Availability: PATENT-3 267 415
NTIS

This invention relates to a system for generating short high-powered pulses in a low impedance circuit, such as in a sonar transmitter, and to means for supplying the power and triggering information to the generator through a high impedance circuit. Primary Keywords: Patents; Remotely; Controlled; Power; Pulse; Generator.
Secondary Keywords: PAT-CL-340-3; NTISGPB
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10400

ELECTRICAL PULSE GENERATOR

A.M. Stott
Department of the Army, Washington, DC
Patent No. PAT-APPL-361 470, (07/1966).
Availability: PATENT-3 259 769
NTIS

The invention relates to electro-mechanical energy converters or generators of the type adapted for converting high-magnitude input impulses of mechanical energy into peak output pulses of electrical energy. Primary Keywords: Patents; Electrical; Pulse; Generator
Secondary Keywords: PAT-CL-310-14; NTISOPA
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10401

MODIFIED MARX GENERATOR

A.E. Schofield
Energy Research and Development Administration
Patent No. PAT-APPL-304 701, (01/1966).
Availability: PATENT-3 229 124
NTIS

This invention relates to voltage multipliers of the Marx type and, more particularly, a modified Marx circuit which minimizes power dissipation and embodies safety features not heretofore found in Marx generators. Primary Keywords: Patents; Marx; Generator
Secondary Keywords: PAT-CL-307-110; NTISOPAC
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10402

MARX DEVELOPMENT PROJECT

Authors Unknown
Maxwell Labs Inc., San Diego, CA 92123
Final rept. No. MRL-49, 378p (04/1970).
Availability: AD-866 671/95T
NTIS

The program requirement was for a compact, fast, highly reliable Marx generator of an "advanced integrated design utilizing components such as switches and capacitors that have been optimized for these applications". A plastic-cased 45 kV, 700 joule energy storage capacitor was developed which exceeds the program goal of 99.97% probability of survival for 5,000 shots in typical Marx generator service. A matching switch with 40 kA peak current capability at 0.6 Cb charge transfer for 40,000 shots life expectancy was also developed; both of these key components were extensively tested and proved. A non-folded Marx circuit, using completely graded construction and employing the novel concept of triggering each stage via a small (fast Marx generator was designed). This circuit was realized, using the specialized Marx capacitor and switch hardware, and a 100 kV, 165 kJ fast Marx generator for practical demonstration of the design. This 6 & microhenry generator is now undergoing a full-energy test program without difficulty. The basic design is extendable with minimal effort to a wide range of energy and voltage. (Author)

Primary Keywords: Pulse Generators; Design; Capacitors; Electric Switches; Sparks
Secondary Keywords: Aurora Project; Marx Generators; NTISDDDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10403

SOLID-STATE FWD MODULATOR

M.H. Mott and D.B. Keveragh
Naval Electronics Lab, San Diego, CA
Research and development rept., Apr 66-Apr 69 No. NELC-1659, 34p (12/1969).
Availability: AD-857 916/95T
NTIS

An S-band linear FM (chirp) signal generator, utilizing a backward wave oscillator (BWO) and a solid-state FWD modulator-driver circuit, was developed as part of an experimental high-range-resolution radar. The modulator-driver BWD was found to have a 3.5 to 2.9 GHz linear sweep with a 600-MHz bandwidth, a 0.300 microsecond pulselength and a pulse compression ratio or time-bandwidth product of 180. In addition, it has the capability of operating to a maximum prf of 25 kHz without distortion of the chirp signal, and its maximum deviation from linear FM is less than 0.07 percent. (Author)
Primary Keywords: Radar; Equipment; Modulators; Modulators; Backward Wave Amplifiers; Signal Generators; Radar Equipment; Pulse Compression; Frequency Modulation; S Band; Resolution
Secondary Keywords: NTISDDDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10404

CHEMICAL REACTION HERTZIAN GENERATOR

K.S. Kunz
BDM Corp, Albuquerque, NM 87106
Final rept. 31 May-31 Dec 73 No. BDM/A-1-74-TR, 139p (05/1974).
Availability: AD-920 469/45T
NTIS

This effort represents a first attempt at combining the two separate technologies of explosive flux compression and Hertzian generation for the purpose of obtaining ultra-high energy pulses at microwave frequencies. A number of interesting concepts were analyzed and three were selected by the contractor for most deserving of future attention. It is hoped that this report will stimulate further imaginative and creative thought in this direction leading eventually to a successful technique for accomplishing the aforementioned goal. (Author)

Primary Keywords: Pulse Generators; Microwave Equipment; Magnetic Fields; Compression; Energy Conversion; Pulses; Power Supplies; High Explosives; Ferroelectric Materials; Energy Storage; Microwave Oscillators; Reaction Kinetics; Frequency Shift; Mirrors; Doppler Effect

Secondary Keywords: Flux Compression; Frozen E Field Devices; Frozen B Field Devices; Brillouin Scattering; Hertzian Generators; Chemical Generators; NTISDDDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10405

DUAL MODE GUN DEVELOPMENT (PHASE I)

A. Saharian
Teledyne Mac Palo Alto Calif
Final rept. 17 Sep 28 Feb 73 (08/1973).
Availability: AD-915 220/85T
NTIS

The major limitation on dual mode tube performance in a TWT is caused by the large gain change that accompanies power change when beam current is varied. A technique is described to reduce this by altering the beam size and current distribution as the total current magnitude is varied. Small signal gain calculations are described for a variety of solid and hollow beam types, test voltages and currents. The effect of varying cathode current is discussed. Two gun designs are presented for both high and low perveance beams. Based on the theoretical calculations two electron guns were designed and built. Current density distribution from these guns was measured in an electron beam analyzer and focusing of the beam produced by one of the guns was measured in a beam tester. (Author)

Primary Keywords: Traveling Wave Tubes; Pulse Amplifiers; Electron Gun; Dual Mode; Electron Beams; Variations; Magnetic Fields; Direct Current; Voltage; Focusing; Gain; Nonlinear Systems; Solenoids; Efficiency; Continuous Waves; Coupling Circuits; Antenna Feeds

Secondary Keywords: Perveance; Hollow Beams; NTISDDDXD
Distribution Restriction: DISTRIBUTION LIMITATION NOW REMOVED.

10406

HIGH CURRENT PULSER CIRCUIT

H.S. Watson
Department of the Navy, Washington, DC
Patent No. PAT-APPL-588 998, 4p (05/1976).
Availability: AD-D002 716/95T
NTIS

The circuit shapes and amplifies a logic pulse to drive loads which require high current levels such as light emitting diodes or semiconductor lasers. Automatic load protection and high speeds are provided by an inductor shunt within the circuit. The simplicity and lack of capacitors in the circuit make it ideal for gun fired applications such as optical telemetry.

Primary Keywords: Pulse Generators; Patents; Circuits; Drivers; Electronics; Logic Circuits; Current Limiters; Stability
Secondary Keywords: PAT-CL-307-270; NTISOPN
Distribution Restriction: THIS GOVERNMENT-OWNED INVENTION AVAILABLE FOR U.S. LICENSING AND, POSSIBLY, FOR FOREIGN LICENSING. COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10407

NOTE ON THE USE OF CHARGE INJECTION FOR SGEMP SIMULATION

C.L. Longmire
Mission Research Corp, Santa Barbara, CA
Topical rept. I-31 Dec 74 No. MRC-N-175, 18p (07/1975).
Availability: AD-A027 218/5T
NTIS

This note discusses techniques and rationale for using self-contained electrical pulsers for simulating system-generated electromagnetic pulse (SGEMP) generated by x rays striking satellites. (Author)

Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; Self Contained; Simulation; Radiation Damage; Nuclear Explosions; X Rays; Artificial Satellites

Secondary Keywords: Charge Injection; SGEMP (System Generated Electromagnetic Pulses); System Generated Electromagnetic Pulses; NTISDDDXA

10408

100-KA DIRECT DRIVE EMP PULSER

J.E. Allen
GTE Sylvania, Inc, Needham Heights, MA 02194
(07/1975).
Availability: PEM-39
NTIS

A pulser is described which was built to directly drive 100 kA into a Minuteman silo closure seal. The pulser has a 50-kV charge voltage, a 10-nanosecond rise time and a 50 microsecond fall time. Physical features and performance characteristics are described along with a summary of its successful operation in pulsing the silo cover. (Author)

Primary Keywords: Electromagnetic Pulses; Simulation; Pulse Generators; Design; Missiles; Silos; Physical Radiation Effects; Capacitors; Nuclear Explosions; Power Supplies; Seals

Secondary Keywords: Minuteman; NTISERDA

256

10409

SPLIT PULSE GENERATOR

D.J. Hoft and P.R. Shutt
Department of the Air Force, Washington, DC
Patent No. PAT-APPL-468 327, 4p (08/1975).
Availability: AD-A001 916/65T
NTIS

The patent describes a split pulse generator which generates a first half-pulse frequency, f sub 1, which is different from the second half-pulse frequency, f sub 2. The output pulse is continuous throughout the pulse width. Thus during transition time in the center of the pulse, the phase is essentially continuous in progressing from f sub 1 to f sub 2.

Primary Keywords: Pulse Generators; Patents; Splitting; Radiofrequency Generators; Radar Equipment
Secondary Keywords: PAT-CL-328-28; AN/TPN-19; NTISOPAF
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 \$0.50.

10410

SPLIT-RING MARX GENERATOR GRADING

D.M. Strickland
Department of the Air Force, Washington, DC
Patent No. PAT-APPL-495 672, 5p (09/1975).
Availability: AD-D001 536/25T
NTIS

The patent concerns metallic tubing bent to a shape consistent with the cross-sectional shape of a Marx generator. Tubing is split into two symmetrical halves and insulated; the halves combined have an initial DC potential equal to one stage voltage, after erection of the Marx the potential collapses to zero.

Primary Keywords: Pulse Generators; Patents; Rings; Control; Transients
Secondary Keywords: Marx Generators; PAT-CL-307-18; NTISOPAF
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 \$0.50.

10411

ELECTROMAGNETIC ASPECTS OF EMP TESTING

E. Marx
Harry Diamond Labs, Adelphi, MD 20783
Technical memo. No. HDL-TR-75-14, 24p (10/1975).
Availability: AD-A018 450/5T
NTIS

General considerations related to testing of complicated systems exposed to EMP by means of a simulator are presented, with special emphasis on the similarities and differences between the pulse generated by a high-altitude burst and the one generated by a simulator. Other aspects of a testing program are also discussed.

(Author)

Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; Test Methods; Electromagnetic Pulses; Airburst; Energy Transfer; High Altitude; Nuclear Explosions; Electronic Equipment; Vulnerability
Secondary Keywords: NTISDODA X8; NTISDODA

10412

PICOSECOND PULSE RESEARCH AT NBS

J.R. Andrews and R.A. Lauten
National Bureau of Standards, Washington, DC
Final rept. (01/1975).
Availability: COM-75-50657/65T
NTIS

A general review of pulse measurement research at the National Bureau of Standards is described which includes work with electrical pulse generators using mechanical switches, avalanche transistors, snap off diodes, tunnel diodes, and laser pulses. Pulse transmission studies which include skin effect, nonuniform dielectric, lossy, liquid dielectric and superconductivity are also mentioned together with pulse measurement techniques which include oscillographic techniques and pulse autocorrelation. The interfacing of picosecond pulse measurement instruments with a minicomputer is also described. This has resulted in an Automatic Pulse Measurement System (APMS) which has been developed to measure transmission coefficient S sub 21 of some microwave networks.

Primary Keywords: Electromagnetic Pulses; Electrical Measurement; Oscilloscopes; Pulse Generators; Pulse Transmitters
Secondary Keywords: Reprints; Pulses; Picoseconds; NTISDODNS
Distribution Restriction: PUB. IN PROCEEDINGS OF JOINT MEASUREMENT CONFERENCE, GAITHERSBURG, MD., 12-14 NOV 74
PI23-140 1975.

10413

A MODEL FOR THE CURRENT PULSES OF CLOUD-TO-GROUND LIGHTNING DISCHARGES

J.H. Gilchrist and J.B. Thomas
Princeton University, Princeton, NJ
(11/1974).
Availability: AD-A015 501/05T
NTIS

A model for the current pulses of cloud-to-ground lightning discharges is proposed. Characteristics of lightning pulses such as finite rise time, decay time and time of occurrence are incorporated in the model. The mean current and power spectral density are calculated using a numerical technique (Anchor).

Primary Keywords: Lightning; Pulse Generators; Electric Discharges; Ground/Electrical; Clouds; Power Spectra; Mathematical Models; Direct Current; Numerical Methods and Procedures; Reprints

Secondary Keywords: Rise Time; Decay Time; Pulse Response; NTISDODXR; NTISDODA; NTISNEG
Distribution Restriction: AVAILABILITY: PUB. IN JNL. OF THE FRANKLIN INSTITUTE, V299 N3 P199-210 MAR 75.

10414

MATCHING A PARTICULAR PULSER TO A PARALLEL-PLATE SIMULATOR

R.W. Lether, M.I. Sancer and A.D. Ververtsis
AFWL, Kirtland AFB, NM 87117
Final rept. 10 Jul-18 Oct 74 (07/1975).
Availability: AD-A013 852/95T
NTIS

An electromagnetic energy source that incorporates the peaking capacitor arms of a Marx generator as part of its electromagnetic configuration is to be used in an Electromagnetic Pulse simulator to be built under the supervision of the Air Force Weapons Laboratory. In this report, the positions of the peaking capacitors that fulfill certain desirable null-flux conditions are determined. The characteristic impedance and several other useful properties of the conical base of the pulser are also calculated.

Primary Keywords: Electromagnetic Pulse Simulators; Pulse Generators; Capacitors; Matching
Secondary Keywords: Marx Generators; NTISDODAF

10415

TEMPS (TRANSPORTABLE EMP SIMULATOR) FINAL REPORT: VOLUME II. APPENDIXES

H. Aslin and R. Ryan
Harry Diamond Labs, Washington, DC 20438
Rept. for 1 Sep 16 Oct 72 No. PJFR-372-D-Vol-2, 220p (08/1973).
Availability: AD-A013 621/85T
NTIS

:Contents: A laboratory study of horizontal dipoles--TEMPS; Capacitor development and testing; Prototype Marx generator switch evaluation; Switch acceptance testing; Solid resistor development; Solid-dielectric gas-graded peaking capacitor; Single-module peaking capacitor tests.

Primary Keywords: Simulators; Electromagnetic Pulses; Pulse Generators; Transportable; Capacitors; Resistors
Secondary Keywords: TEMPS; Electromagnetic Pulse Simulators; NTISDODA

10416

TEMPS (TRANSPORTABLE EMP SIMULATOR) FINAL REPORT: VOLUME I

H. Aslin and R. Ryan
Harry Diamond Labs, Washington, DC 20438
Rept. for 1 Sep 71-16 Oct 72 No. PJFR-372-D-Vol-1, 23p (08/1973).
Availability: AD-A013 620/05T
NTIS

This report presents a description of the development, design, fabrication, and field testing of the TEMPS (Transportable EMP Simulator). The basic system is a simulator with the geometry of a cylinder parallel to the ground surface, driven at its center by a high voltage capacitive pulser and terminated resistively at its ends to ground. The pulse and cylindrical antenna are supported by means of a dielectric support structure at elevations of up to 20 meters, measured from the antennae/pulse centerline to ground. Essentially, TEMPS has three individual subsystems: the pulse generator, the cylindrical antenna, and the support structure.

Primary Keywords: Simulators; Electromagnetic Pulses; Pulse Generators; Transportable; Antennas
Secondary Keywords: TEMPS; Electromagnetic Pulse Simulators; NTISDODA

10417

PULSE GENERATOR EMPLOYING PLURAL PULSE-FORMING-NETWORKS WITH PULSE PRODUCING MEANS FOR CANCELLATION OF UNDESIRABLE REFLECTED PULSE

M.J. Coyle
Department of the Army, Washington, DC
Patent No. PAT-APPL-283 124, 3p (05/1965).
Availability: AD-D000 650/05T
NTIS

The patent provides a pulse generating circuit which avoids undesirable re-excitation by providing a thyratron tube in one of the pulse forming networks so that the network is terminated in a short circuit at the time the impulse arrives thereto. Due to the action of the thyratron the polarity of the impulse is reversed in the shorted pulse forming network. Thus, the impulses in the two pulse forming networks will be of opposite polarity and will cancel one another when they are reflected back to the load circuit. Hence there can be no re-excitation of the load. It is the principal object of this invention to provide a pulse generating circuit wherein impulses transmitted thereto can be eliminated rather than reflected.

Primary Keywords: Pulse Generators; Patents; Pulses; Reflection; Cancellation

Secondary Keywords: PAT-CL-328-65; NTISOPA
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 \$0.50.

10418

PULSE GENERATOR EMPLOYING PLURAL PULSE FORMING NETWORKS PROVIDING OVERLAPPED PULSES TO EFFECT RIPPLE CANCELLATION

G.F. Grotz and M.J. Coyle
Department of the Army, Washington, DC
Patent No. PAT-APPL-265 600, 3p (06/1965).
Availability: AD-D000 841/75T
NTIS

The patent relates to pulse forming circuits and more particularly it relates to a pulse forming circuit for supplying very high voltage pulses to microwave transmitter tubes such as klystrons, traveling wave tubes or magnetrons.

Primary Keywords: Pulse Generators; Patents; Microwave Equipment; Ripples; Cancellation; Transmitters; Microwave Tubes
Secondary Keywords: PAT-CL-328-162; NTISOPA

Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 \$0.50.

10419

CRACK DETECTION APPARATUS AND METHOD

J.G. Sessler and V. Weiss
Department of the Navy, Washington, DC
Patent No. PAT-APPL-345 164, 5 (02/1975).
Availability: AD-D000 730/25T
NTIS

The patent describes an apparatus and method for non-destructively detecting the presence and the location of crack in materials, using low frequency mechanical vibrations. The material specimen or structure having a crack to be detected is subjected to tensile or compressive forces due to excitation caused by low frequency sound waves or mechanical vibrations from a generator, thus changing the opening and thereby changing the effective size of the crack in the specimen. An ultrasonic search unit is used to follow modulations of reflected energy at the crack interface due to variations of the effective size of the crack. The search unit is controlled by an ultrasonic pulser/receiver which displays the amplitude of echo from the crack on an oscilloscope.

Primary Keywords: Ultrasonic Tests; Ultrasonic Inspection; Nondestructive Testing; Patents; Cracks; Detection; Pulse Generators

Secondary Keywords: PAT-CL-73-67-5-R; NTISOPN
Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 \$0.50.

10420

DEVICE FOR CHARGING ACCUMULATOR OF A POWERFUL PULSED GENERATOR
 A.G. Nikolaev, V.A. Knyshev, P.E. Konchukov and V.A. Maimushin
 Army Foreign Sci and Tech Center, Charlottesville, VA
 No. FSTC-HT-23-128-74, 6p (06/1974).

Availability: AD-A008 247/95T
 NTIS

A device for charging the accumulator of a powerful pulse generator with increased reliability of operation and protection from overloads and overvoltages is described and illustrated by a diagram. The circuit can keep the resonance with the power supply source; breakdown of the stabilization in the overvoltage protection unit short circuits the power supply and decreases the voltage in the circuits of the device. This prevents overloads and overvoltages on the accumulator.

Primary Keywords: Pulse Generators; Accumulators; Electric Charge;

Patents; Translations; USSR

Secondary Keywords: NTISDODA

10421

ELECTRON BEAM DIODE POWER ACCUMULATOR

M. Braun and K. Gerewel
 ECOM, Fort Monmouth, NJ 07703
 Final rept. 30 May 72-30 Oct 74 (12/1974).
 Availability: AD-A008 510/05T
 NTIS

A pulse 'power accumulator' amplifier consisting of an output section as power combiner, input tuners and plug-in tubes was designed and fabricated. The output section of the accumulator was designed to operate over a frequency range of 500-1000 MHz and combined r.f. power from four individual plug-in tubes operating in a parallel push-pull mode. Plug-in FES tubes capable of operation in the frequency range of 500-1000 MHz were fabricated. The diodes in these tubes were capable of 200V or more, reverse back bias voltage.

Primary Keywords: Electron Tubes; Pulse Amplifiers; Electron Tube Targets; Semiconductor Devices; Electron Beams; Diodes; Silicon

Secondary Keywords: Electron Beam Semiconductor Devices; NTISDODA

10422

ELECTROMECHANICAL PULSER INVESTIGATION

J.P. Craig, M.O. Hagler and K.I. Selin
 RADC, Griffiss AFB, NY 13440
 Final rept. 1 Mar 73-28 Feb 74 No. A-002-RADC-1-74, 158p (09/1974).
 Availability: AD-787 674/15L
 NTIS

The report concerns a feasibility study of electromechanical pulsers for the production of short duration, high power pulses with a low duty cycle. The pulse repetition rate is 0 200 pps. The output pulses are 40 kV, 1KA into a 40 ohm resistive load, with pulse duration between 20 and 40 μ s and with rise and fall times of 3 μ s or less. Several different approaches have been considered in an attempt to meet the requirements. These include variable capacitance, variable reluctance, piezoelectric and electromagnetic methods with and without cryogenic fields. It was found that it is feasible to use an electromechanical pulser with some recommended switching schemes to meet the required pulse shape. Without switching, rise times approximately 15 μ s and fall times approximately 10 μ s are feasible. For some applications, a major advantage of an electromechanical pulser over conventional pulse methods is that high repetition rate bursts for short periods of time can be obtained. (Modified author abstract)

Primary Keywords: Pulse Generators; Electromechanical Devices; Feasibility Studies

Secondary Keywords: NTISDODAF

10423

DELAYED PULSE GENERATOR

G.J. Helub
 Department of the Navy, Washington, DC
 Patent No. PAT-APPL-236 016, 4 (05/1973).
 Availability: AD-164 968/05L
 NTIS

The patent describes a delayed pulse signal of a predetermined pulse width obtained by having a free running clocking pulse generator provide a series of pulses to a first shift register. The first shift register provides a time delay for a predetermined number of pulses before supplying the delayed pulse signal and an enabling signal to a second shift register. The second shift register provides an output signal that inhibits the clock and at the same time inhibits the delayed pulse by resetting the first shift register.

Primary Keywords: Pulse Generators; Patents; Delay; Shift Registers

Secondary Keywords: PAT-CL-328-55; NTISGP

Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
 COMMISSIONER OF PATENTS, WASHINGTON, D.C.
 20231 80-50.

10424

A HIGH INTENSITY PULSED SOURCE OF POLARIZED ELECTRONS

M.J. Alquird (1), K.P. Schueler (1), R.D. Ehrlich (2), G. Baum (2) and V. Houghes (1)
 (1) Yale Univ., New Haven, CT
 (2) Office of Naval Research, Alexandria, VA
 (3) Chicago Operations Office(AEC), IL
 (01/1974).

Availability: AD-287 001/5T
 NTIS

A polarized electron source using the principle of photoionization of a polarized beam of Li⁶ atoms has been developed. Originally suggested by Fues and Hellmann in 1930 this method led to one of the earliest successful developments of a low-energy prototype source of polarized electrons. The present source, currently being installed at the Stanford Linear Accelerator Center (SLAC), is based upon the prototype design.

Primary Keywords: Electron Beams; Polarization; Photoionization; Pulse Generators; Lithium; Atomic Beams

Secondary Keywords: Lithium; NTISDODA

Distribution Restriction: AVAILABILITY: PUB. IN INTERNATIONAL CONFERENCE ON ATOMIC PHYSICS (4TH), ABSTRACTS OF CONTRIBUTED PAPERS, HEIDELBERG (WEST GERMANY), 27-26 JUL 74.

10425

PICOSECOND PULSE GENERATORS USING MICROMINIATURE MERCURY SWITCHES
 J.R. Andrews
 National Bureau of Standards, Boulder, CO 80302
 Final rept. FFY 1973 No. NBSIR-74-377, 45p (03/1974).
 Availability: COM-74-114497/

NTIS

Pulse generators have been built using microminiature mercury switches. A commercial RF coaxial switch was also evaluated as a pulse generator. A superconducting delay line ($t_{sub r} = 18$ ps, $t_{sub d} = 70$ ns) and a sampling oscilloscope ($t_{sub r} = 22$ ps) were used to measure the generated pulse 10x-90% transition time. The best result obtained was a transition time of 39 ps. Pulse amplitudes were independently adjustable up to 50 volts. The microminiature mercury switches in general were found to give very unreliable operation.

Primary Keywords: Pulse Generators; Waveform Generators; Electric

Switches; Mercury; Microminiaturization

Secondary Keywords: Mercury Switches; Picoseconds; NTISDNNBS

10426

HIGH INTENSITY, PULSED THERMAL NEUTRON SOURCE

J.M. Carpenter
 Atomic Energy Commission, Washington, DC
 Patent No. PAT-APPL-351 893, 8p (12/1973).
 Availability: PATENT-3 778 627

NTIS

The invention relates generally to neutron sources and more particularly to pulsed thermal neutron sources. Specifically, this invention is concerned with a novel apparatus for slowing down fast neutrons in such a manner as to create highly intense pulses of thermal neutrons.

Primary Keywords: Neutron Sources; Patents; Pulse Generators; Thermal Neutrons; Moderators

Secondary Keywords: PAT-CL-250-499; NTISGAEC

Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
 AVAILABLE COMMISSIONER OF PATENTS,
 WASHINGTON, D.C. 20231 80-50.

10427

CHEMICA: TO ELECTROMAGNETIC ENERGY CONVERSION TECHNIQUES

R.W. Wanick
 Advanced Kinetics Inc., Costa Mesa, CA
 Final rept. May 72-Mar 74 (06/1974).
 Availability: AD-183 901/2

NTIS

The objective of the work was to develop techniques for conversion of the very high density energy stored chemically to pulses of electrical energy. Reliable, low cost single shot converters have been demonstrated by investigators in explosive flux compression technology. The techniques investigated are for use in high power lightweight transmitter experiments in support of TP05. Multiple shot magnetic flux compression concepts were analyzed, experimentally verified, and categorized as to potential device use. The concepts investigated have the capability for multiple pulse operation and all involved the rapid deceleration of either explosively driven shock fronts or explosively driven metallic projectiles in a magnetic field. The effects of physical parameters of the decelerated medium and the magnetic field were experimentally verified and parameter tradeoffs were developed.

Primary Keywords: Energy Conversion; Pulse Generators; Magnetic Field; Exothermic Reactions; Detonation Waves; Pistons; Compression; Explosives; Flux(Rate); Interactions; Projectiles; Magnets; Electromagnetic Pulses; Acceleration; Deceleration; Multiple Operation

Secondary Keywords: NTISDODAF

10428

ANALYSIS OF DISCRETE PULSE FORMING NETWORKS DRIVING NON-LINEAR FLASH LAMP LOADS

O.C. Barr
 Naval Research Lab, Washington, DC 20375
 Final rept. No. NRL-RR-2808, 76p (06/1974).
 Availability: AD-782 399/0

NTIS

An interactive design tool for analyzing discrete lumped parameter pulse forming networks driving time invariant nonlinear flashlamp loads is described. The program is written in FORTRAN IV for the Control Data Kronos timesharing system. The program handles linear (resistive) loads as well as xenon flashlamps. The formulation is structured to allow easy modification. Up to 10 mesh PFN's can be handled. (Author)

Primary Keywords: Pulse Generators; Flash Lamps; Xenon Lamps; Mathematical Models; Electrical Networks; Computer Programs; FORTRAN

Secondary Keywords: Network Analysis Theory; FORTRAN 4 Programming Language; CDC 6400 Computers; Pulse Forming Networks; NTISDODN

10429

ANALYSIS OF THE OPERATING REGIMES OF AN IMPULSE UNIPOLE GENERATOR WITH REGULATION OF EXCITATION FLUX

V.V. Kharitonov
 Army Foreign Sci and Tech Center, Charlottesville, VA
 No. FSTC-HT-23-1883-73, 16p (04/1974).
 Availability: AD-781 225/8

NTIS

A method of calculating transient processes in the field circuit of an impulse unipole generator with mass vs magnetic conductor is examined. Based on the method, several generator operating regimes with regulation of excitation flux are analyzed.

Primary Keywords: Pulse Generators; Transients; Excitation; Computations; Translations; USSR

Secondary Keywords: NTISDODA

10436

DEVELOPMENT OF AN ELECTRICAL DISCHARGE IN GAPS WITH GREAT OVERVOLTAGE
AT LOW AIR PRESSURE
Y.I. Bychkov, V.V. Osipov, Y.A. Kurbatov and A.G. Filonov
Army Foreign Sci. and Tech. Center, Charlottesville, VA
No. FSTC-MT-23-182-73, 8p (08/1973).
Availability: AD-781 13773
NTIS

The physical processes responsible for breakdown of gas gaps with overvoltages of a few percent have been studied in a number of works both oscillographically and optically. Theoretical calculations have shown that known experimental facts are explained well by the theory of Townsend avalanche generation. In the present work, the authors studied the development of a discharge in gaps of 1-6 cm with overvoltages of 2-20 times, and also measured the time characteristics, both the discharge delay time ($t_{\text{sub}} d$), the time of switching to the 0.5 (U sub 0) level and the duration of the 'step' as functions of the electric field voltage.

Primary Keywords: Electric Discharges; Glow Discharges; Gas Discharges; Pulse Generators; Low Pressure; Translations; USSR

Secondary Keywords: NTISDDDA

10431

EBS (ELECTRON BEAM SEMICONDUCTOR) PULSE AMPLIFIER LIFE TEST
Authors Unknown
Watkins-Johnson Co., Palo Alto, CA
Final engineering rept. 13 Feb 73-28 Jan 74. (01/1974).

Availability: AD-779 908/3
NTIS

Highly stable, high voltage, beam shield passivated diodes were fabricated for use in EBS (electron beam semiconductor) grid controlled pulse amplifiers. Six EBS pulse amplifiers were fabricated using these diodes and four of the EBS amplifiers were operated on life test for a total socket time of 14,500 hours. Data is presented showing that stable diode operation was obtained. (Author)

Primary Keywords: Pulse Amplifiers; Electron Beams; Semiconductor Diodes; Electron Tube Targets; Electron Tubes; Life Tests

Secondary Keywords: NTISH

10432

A DEVICE FOR FORMING PULSES WITH A STEEP FRONT
I.G. Kataev
Naval Research Lab., Washington, DC 20375
No. NRL-Trans-1293, 3p (05/1974).

Availability: AD-779 897/8
NTIS

The patent describes a device for forming pulses with a steep front, which includes an artificial delay line with lumped parameters and which differs in that, for the purpose of increasing the steepness of the pulse front, the elements of the line are capacitors with a ferroelectric and inductance made of ferrites connected by one of the familiar circuits for a delay line.

Primary Keywords: Electrical Networks; Pulse Generators; Pulses; Patents; Delay Lines; Translations; USSR

Secondary Keywords: NTISH

10433

EXPLOSIVE ELECTRON EMISSION AND THE CHARACTERISTICS OF HIGH-CURRENT ELECTRON FLOW
R.K. Parker
AFML Kirtland AFB, NM 87117

Final rept. Oct 70-Jan 73 No. AFML-TR-73-92, 298p (02/1974).
Availability: AD-775 992/1
NTIS

Within the past several years, an increasing effort has been concentrated on the development of high-current, relativistic electron beams. Initially, this effort had been impeded by limitations in the high-voltage and pulsed-power technology required to develop pulsed, high-power electron accelerators. These technologies have been developed to a level where powers on the order of 10 to the 13th power watts are now available for time durations of approximately 10 microseconds. Emphasis is now more recently on current control and controlling these beams. The initial behavior of the beam within the diode region of the accelerator becomes an extremely critical element. The high-current, cold-cathode diode which is distinguished by non-self-convergent electron flow has been studied to define operative electron emission mechanisms, to determine the dominant plasma phenomena within the interelectrode volume, to classify the modes of electron flow, and to verify the Friedlander beam convergence criterion. (Modified author abstract)

Primary Keywords: Electron Beams; Electron Accelerators; Electron Emission; Pulse Generators; Plasmas(Physics); Diodes; X Rays; Relativity Theory; Wave Equations

Secondary Keywords: AF

10434

HERTZIAN GENERATOR DEVELOPMENT
S.D. Houston and D. Berlin
BDM Corp., Albuquerque, NM 87106
Technical rept. (Final) No. BDM/A-90, 74p (12/1973).

Availability: AD-774 567/2
NTIS

The report summarizes the results of a one-year theoretical and experimental study of the frozen wave Hertzian concept for electromagnetic wave generation. The bulk of the effort was devoted to the switch problem, in particular, switch synchronization. Several configurations are evaluated and the design of a 200 MHz generator is treated in some detail. Limitations on frequency, efficiency, power, e.c., are discussed in terms of available switch technology, materials, etc. (Author)

Primary Keywords: Radiofrequency Generators; Ultrahigh Frequency; Very High Frequency; Pulse Generators; Generators; Microwaves

Secondary Keywords: AF

10435

ELECTRON BEAM SEMICONDUCTOR DEVICES
M. Braun and K. Gervais
Machlett Labs Inc., Stamford, CT
Final rept. 1 Mar 72-21 Feb 73 (07/1973).
Availability: AD-766 740/5
NTIS

During the course of the contract, five EBS amplifiers, designated as EE-155, end 15 mounted EBS diodes, designated as EE-154, A and B, were developed, fabricated and delivered to the USAECOM. Diode area was 10 sq. cm and 20 sq. mm., active width of N region 25 micrometers, peak current density 0.15 amp/cm². The electron beam of the amplifiers is generated and modulated in a cathode grid structure, with a focus electrode for beam diameter control. Best back bias voltage of the 20 diodes delivered exceeds 400 volts, with an average of 300 volts. First tests at USAECOM were done on a 20 sq. mm diode tube at 235V back bias voltage. Peak current into 3.8 ohm load was 46A, a peak power of 8 KW with a pulse risetime of 1.5 ns. Riser time, when corrected for the input pulse, is approximately 1 ns. (Author)

Primary Keywords: Microwave Amplifiers; Pulse Amplifiers; Diodes(Semiconductors); Radiofrequency Amplifiers; Electron Tube Targets; Reliability(Electronics); Manufacturing Methods; Electron Beams

Secondary Keywords: Electron Beam Semiconductor Devices; A

10436

SOLID STATE PULSER USING PARALLEL STORAGE CAPACITORS
D.J. Amberg and R.A. Colantano
Department of the Army, Washington, DC
Patent No. PAT-APPL-72 954, 4p (07/1972).

Availability: AD-163 796/6
NTIS

The patent describes a solid state pulse generator that produces high current narrow pulses and includes a bank of parallel silicon controlled rectifier-capacitor combinations, designed for driving a gallium arsenide diode laser. A trigger circuit is connected to all the gate circuits of the silicon controlled rectifiers, through separate adjustable resistors. The adjustable resistors were not possible to simultaneously fire the silicon controlled rectifiers with a single trigger pulse.

Primary Keywords: Lasers; Pulse Generators; Pulse Generators_Patents; Photo-Lasers; Gallium Arsenide Lasers;

Secondary Keywords: CL-374-11; Gallium Arsenide Lasers; Semiconductor Lasers; Light Emitting Diodes; Injection Lasers; GPA

Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING. COPY OF PATENT AVAILABLE
AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C.
20231 \$0.50.

10437

CIRCUIT PROTECTING, GAS-TUBE, DISCHARGE INTERRUPTER
S. Schneider and G.W. Taylor
Department of the Army, Washington, DC
Patent No. PAT-APPL-79 460, 4p (11/1970).

Availability: AD-165 603/4
NTIS

The patent relates to energy control and particularly to energy control in the form of isolation and protection for multiple, amplifier circuits operating from a common power source. More particularly, the disclosure is in the use of gas tubes as switches for isolating and protecting individual pulse-amplifier circuits or units of a multiple-unit system having a common power supply. This disclosure teaches the connection of a gas tube controlled by a magnetic field to each of the circuits to switch it off when the circuit faults or short circuits and to switch the circuit back on when the fault clears itself. This avoids draining the main capacitor bank through the short-circuit, which could damage the individual circuit and interfere with the operation of other circuits using the same, common, power supply.

Primary Keywords: Switching Circuits; Discharge Tubes; Patents_Switching Circuits; Power Supplies; Control Systems; Pulse Amplifiers; Electric Switches

Secondary Keywords: PAT-CL-317-51; GPA
Distribution Restriction: AVAILABILITY: GOVERNMENT-OWNED INVENTION
AVAILABLE FOR LICENSING. COPY OF PATENT
AVAILABLE COMMISSIONER OF PATENTS,
WASHINGTON, D.C. 20231 \$0.50.

10438

GAS TUBE ISOLATOR AND CHARGING CIRCUIT FOR PULSE AMPLIFIERS IN PHASED ARRAYS
S. Schneider
Department of the Army, Washington, DC
Patent No. PAT-APPL-95 174, 5p (12/1971).

Availability: AD-165 579/6
NTIS

The patent relates to energy control and particularly to energy control for charging energy storage devices and for isolating and protecting multiple amplifier circuits operating from a common power supply. More particularly, disclosure relates to the use of a gaseous tube as a switch for charging the energy storage capacitor bank of an individual pulse amplifier circuit or unit of a multiple unit system having a common power supply.

Primary Keywords: Switching Circuits; Discharge Tubes; Patents_Switching Circuits; Pulse Amplifiers; Phased Arrays; Power Supplies; Control Systems

Secondary Keywords: PAT-CL-317-51; GPA
Distribution Restriction: AVAILABILITY: GOVERNMENT-OWNED INVENTION
AVAILABLE FOR LICENSING. COPY OF PATENT
AVAILABLE COMMISSIONER OF PATENTS,
WASHINGTON, D.C. 20231 \$0.50.

10439

DISCHARGING OF INDUCTIVE POWER ACCUMULATOR FOR GENERATING SHORT-FRONT PULSE
V.N. Bolshakov
Joint Publications Research Service, Arlington, VA
(05/1973).

Availability: JPRS-58892
NTIS

The report contains a discussion of the basic parameters of the discharge circuit of an inductive accumulator for generating a current pulse with a short front.

Primary Keywords: Pulse Generators_Electric Coils; Discharge; Power Supply Circuits; USSR; Translations

Secondary Keywords: JPRS

10440

ELECTRON BEAM SEMICONDUCTOR SHORT PULSE GENERATOR
 A. Silvers and R.I. Knight
 Watkins-Johnson Co., Palo Alto, CA
 Final rept. 1 Aug 70-1 Oct 72 No. M-J-22-4083-F, 91pM (05/1973).
 Availability: AD-761 111
 NTIS

Detailed analysis, design, and experimental verification of an electron beam semiconductor (EBS) amplifier for a high-speed high-current switching application has been completed. A large-signal computer simulation predicts that with an ideal diode structure over 450 amperes of output current can be achieved into an 0.5 ohm load with a risetime of less than 0.7 nanosecond. A gridded gun design was used as the most suitable approach. The cathode-grid structure showed over 80 percent of the design goal performance with uniform current density at the target position. Large area semiconductor targets of 0.35 sq. cm. and 1.40 sq. cm. active area have been successfully fabricated from 37 micrometers thick, 22 ohm/cm epitaxial silicon. The best diodes have leakage currents of less than 10 mA at 250 volts reverse breakdown voltage. Tube processing and pulsed operation did not change the diode characteristics. (Author)

Primary Keywords: Pulse Amplifiers; Design; Electron Tube Targets; Diodes; Semiconductors; Electron Guns; Silicon; Reliability(Electronics); Manufacturing Methods

Secondary Keywords: Computer Aided Design; A

10441

HIGH EFFICIENCY CURRENT DRIVER

L. Simpson
 Department of the Army, Washington, DC
 Patent No. PAT-APPL-717 196, 4p (12/1970)
 Availability: AD-163 516/8
 NTIS

The driver is concerned with providing high current pulses of positive and/or negative polarity as desired. The device is charged by a D.C. voltage through a high impedance resonant network and discharged through a low impedance resonant network that includes a SCR that is turned on as desired by small current gating signals. A large current pulse, on the order of 25 amps during discharge, is inductively coupled to an output winding.

Primary Keywords: Pulse Generators; Patents; Electric Currents
Secondary Keywords: PAT-CL-320
Distribution Restriction: AVAILABILITY: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING, COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10442 **EXPERIMENTAL AND ANALYTICAL RESEARCH ON A TWO MEGAWATT, HIGH PERFORMANCE MHD GENERATOR**

D.K. Sonju and J. Teno
 Avco Everett Research Lab., Inc., Everett, MA 02149
 Interim rept. 1 Apr 71-1 Oct 72 (10/1972).
 Availability: AD-756 489
 NTIS

The report presents the initial results of a combined analytical and experimental program whose broad objectives are to achieve a more complete understanding of the operation and appropriate design techniques of compact high-performance MHD generators by further establishing a knowledge base and performance of these generators and to demonstrate the feasibility of operating compact high-performance MHD generators under a repetitively pulsed mode of operation at high power levels—in this case at 2 MW level. In particular, the results, of studies of stability, and effects, transient response, diagnostic, rapid startup, channel voltage breakdown and performance optimization are discussed and summarized. A parallel effort under this program has been directed to constructing a generator test facility and designing and fabricating a 2 MW high-performance MHD generator system to be used in the test facility. (Author)

Primary Keywords: Magnetohydrodynamic Generators; Scientific Research; Magnetohydrodynamics; Combustion Chambers; Nozzles; Heat Transfer; Cooling; Magnets; Water; Pulse Generators; Electrodes; Mass Transfer; Circuits; Graphics; Efficiency; Transients

Secondary Keywords: Viking I Program

10443 **A 750 KW PULSE GENERATOR AND ITS USE FOR THE PRODUCTION OF X-RAY AND ELECTRON FLASHES**

F. Hattierom, F. Jamet and G. Thomer
 Institut Franco-Allemand Recherches, St. Louis, France
 Mo. ISL-10/72, 37p (03/1972).
 Availability: NTIS-12472
 NTIS

A Marx generator producing in vacuum impulses from 200 to 750 kV is described. Its elements are immersed in eralidite and coaxially mounted in a nitrogen pressurized chamber. The self-induction of the set-up is 1.5 micro H when used with a flash tube. The X-ray impulses are characterized by their high intensity and a 25 nsec pulse duration. This generator is suitable for electron pulse production and therefore for experiments on semiconductor pumping when used in conjunction with beryllium window tubes. (Author)

Primary Keywords: Electrons; Pulse Generators; X Rays; Electron Photography; Experimental Design; Flash Lamps; Optical Pumping; Pulse Duration; Radiography

10444 **DISCHARGE IN GAS AT HIGH PRESSURE INITIATED BY A BEAM OF FAST ELECTRONS**
 B.M. Kovalchuk
 Defence Research Information Centre, Orpington (England).
 No. DRIC-TRAHs-2857, 16p (08/1971).
 Availability: NTIS-11716
 NTIS

Discharge in nitrogen at pressures up to 16 atm, initiated by a beam of electrons with an average energy of 100 to 350 kev was investigated. A channel-free form of discharge was obtained with voltages above 100,000 V and switching currents of some tens of kA. The channel-free form of discharge is characterized by absorption in the gas of specific power of the order of 10 to 1000 MW/cm² or more in a time interval of the order of 100 microseconds. (Author)

Primary Keywords: Electron Beams; Gas Discharges; High Pressure; Nitrogen; Electric Pulses; Electron Avalanche; Pulse Amplitude; Pulse Generators; Spark Gaps

10445

METHOD OF GENERATING UNIPOLAR AND BIPOLAR PULSES

N.E. Dixon
 Atomic Energy Commission, Washington, DC
 Patent No. PAT-APP-111 937, 10p (04/1972).
 Availability: PAT-3 636 012
 NTIS

The method for generating bipolar and unipolar mechanical pulses is described. The unipolar pulses can be in a form of a single unipolar pulse or pairs of unipolar pulses of opposite polarity. (Author)

Primary Keywords: Transducers; Patents; Ultrasonic Tests; Transducers; Pulse Generators; Nondestructive Tests

Secondary Keywords: Pat-cl-310-8-1

Distribution Restriction: GOVERNMENT-OWNED INVENTION AVAILABLE FOR LICENSING, COPY OF PATENT AVAILABLE COMMISSIONER OF PATENTS, WASHINGTON, D.C. 20231 \$0.50.

10446

EXPLOSIVE-DRIVEN EMP GENERATOR

K.M. See Hoo
 Aerospace Corp., El Segundo, CA 90245
 Rept. for Jul 71-Jun 72 No. TR-0073(3542-02)-1, 33p (11/1972).
 Availability: AD-751 907
 NTIS

The feasibility of radiating large quantities of energy from a satellite is discussed. A system comprised of an explosive generator source, switching and matching networks, and a bent-dipole antenna is theoretically analyzed. The calculations indicate that an electric field of 4000 V/m can be produced at a distance of 1 mile from the source. (Author)

Primary Keywords: Pulse Generators; Electromagnetic Pulses; Explosions; Dipole Antennas; Satellites(Artificial)

Secondary Keywords: Explosive Generators

10447

THE POSSIBILITY OF USING LIQUID DISCHARGERS IN HIGH-VOLTAGE NANOSECOND PULSE CIRCUITS

D.A. Mezayev and G.A. Vorobev
 FTD, Wright-Patterson AFB, OH
 No. FTD-HT-23-939-72, 16p (09/1972).
 Availability: AD-751 170
 NTIS

The article compares the commutation time $t_{sub k}$ of air and oil dischargers and shows that in the latter $t_{sub k}$ is less. It is also found that the durability of the oil during short pulses does not depend on its humidity. (Author)

Primary Keywords: Electric Discharges; Dielectrics; Oils; Air; USSR

Secondary Keywords: Insulating Oil; Translations; Dielectric Breakdown

10448

MULTIMEGAJOULE PULSED POWER GENERATION FROM A REUSABLE COMPRESSED MAGNETIC FIELD DEVICE

M. Cowan, E.C. Chare, W.K. Tucker and D.R. Messengers
 Sandia Labs, Albuquerque, NM 8715
 No. CONF-741163-2, 4p (09/1972).
 Availability: SAND-75-5576
 NTIS

For abstract, see NSA 32 08, number 19584.

Primary Keywords: Pulse Generators; Design; Combustion; Performance; Superconducting Magnets; Switching Circuits

Secondary Keywords: NTISERDA

10449

THREE-CAP SPARK DISCHARGER FOR SPARK CHAMBER SUPPLY

G.D. Alekseev and D.M. Khazin
 Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
 (01/1974).
 Availability: JINR-P13-8390
 NTIS

For abstract, see NSA 32 01, number 88919.

Primary Keywords: Spark Chambers; High-voltage Pulse Generators; High-voltage Pulse Generators; Design; Performance; Pulse Rise Time; Rising Properties

Secondary Keywords: NTISERDA

Distribution Restriction: IN RUSSIAN. U.S. SALES ONLY.

10450

UNTRIGGERED MULTICHANNEL OIL SWITCHING

D.L. Johnson
 Sandia Labs, Albuquerque, NM 87115
 No. CONF-741113-2, 16p (01/1974).
 Availability: SAND-74-5590
 NTIS

For abstract, see NSA 31 06, number 14735.

Primary Keywords: Electrostatic Accelerators; High-voltage Pulse Generators; High-voltage Pulse Generators; Switching Circuits; Operation; Performance; Pulse Rise Time;

Secondary Keywords: NTISAC

10451 **2 MV, MULTICHANNEL, OIL-DIELECTRIC, TRIGGERED SPARK GAP**

K.R. Prestwich
 Sandia Labs, Albuquerque, NM 87115
 No. CONF-741113-3, 22p (01/1974).
 Availability: SAND-74-5270
 NTIS

For abstract, see NSA 31 06, number 14734.

Primary Keywords: Electrostatic Accelerators; High-voltage Pulse Generators; High-voltage Pulse Generators; Switching Circuits; Spark Gaps; Switches; Trigger Circuits

Secondary Keywords: NTISAC

10452 **HIGH-VOLTAGE POWER SUPPLY FOR A HIGH-CURRENT INJECTOR**
 I.T. Venetovsk, G.M. Skoromnyi, Z.E. Ptukhina, E.I. Revutskii and V.V. Verbovskii
 AN Ukrainskoj SSR, Khar'kov Fiziko-Tekhnicheskij Inst.

Availability: BNL-tr-579
 NTIS

For abstract, see NSA 31 02, number 04064.

Primary Keywords: High-voltage Pulse Generators; Specifications; Accelerators; High-voltage Pulse Generators; Beam Injection; Electronic Circuits; Power Supplies

Secondary Keywords: NTISAC

Distribution Restriction: TRANSLATED BY S.J. AMORETTY FROM PP 66-68 OF KHTI--73-13.

260

10453

PULSED CASCADE TRANSFORMER
I.Y. Venetovskiy, O.M. Skoromnyi and E.I. Revutskii
AN Ukrainskoj SSR, Khar'kov Fiziko-Tekhnicheskij Inst.
Availability: BNL-tr-377
NTIS

For abstract, see NSA 31 02, number 04863.

Primary Keywords: Linear Accelerators; High-voltage Pulse Generators;
Beam Injection; Particle Boosters; Power Supplies;
Transformers

Secondary Keywords: NTIS/SEC

Distribution Restriction: TRANSLATED BY S.J. AMORETTY FROM PP 69-71 OF
KHFTI-73-13.

10454

SOME PECULIARITIES OF OPERATION OF CURRENT COMMUTATOR ON INDUCTIVE LOAD
L.S. Barabash, S.M. Bliskii and V.A. Timokhin
Joint Inst. for Nuclear Research, Dubna (USSR).
(01/1974).

Availability: JINR-P9-7773
NTIS

For abstract, see NSA 30 03, number 07489.

Primary Keywords: Accelerators; Pulsed Magnet Coils; Pulsed Magnet
Coils; Pulse Circuits; Electronic Circuits; Power
Supplies; Pulse Generators; Semiconductor Diodes;
Thyristors

Secondary Keywords: NTIS/SEC

Distribution Restriction: IN RUSSIAN. U.S. SALES ONLY.

10455

INVESTIGATION OF THE RE-ESTABLISHMENT OF IMPULSE ELECTRICAL STRENGTH
AFTER DISCHARGE IN SPARK CHAMBERS WITH SMALL CLEARANCE
V.I. Martynov and V.V. Rylov
Gosudarstvennyj Komitet Po Ispech' Zavaniyu Atomnoj Ehnergetiki SSSR,
Moscow. Inst. Teoreticheskoi I Ehksperimental'noj Fiziki.
(01/1973).

Availability: ITEF-25
NTIS

For abstract, see NSA 29 07, number 15764.

Primary Keywords: Spark Chambers; Operation; Electric Discharges;
Electric Potentials; High-voltage Pulse Generators;
Timing Properties

Secondary Keywords: AEC

Distribution Restriction: IN RUSSIAN. U.S. SALES ONLY.

10456

SMALL PULSE BREAKDOWN PHENOMENON IN MINERAL INSULATED CABLES
K.W. McMinn
Ukran Reactor Group, Winfrith. Atomi: Energy Establishment.
(12/1973).

Availability: AEEW-R-910
NTIS

For abstract, see NSA 29 07, number 15673.

Primary Keywords: Neutron Detectors; Electric Cables; Electric
Cables; Breakdown; Dielectric Materials; Gases;
Minerals; Pulse Circuits

Secondary Keywords: AEC

Distribution Restriction: U.S. SALES ONLY.

10457

ELECTRON-BEAM-CONTROLLED GAS LASERS: DISCUSSION FROM THE ENGINEERING
VIEWPOINT: PART II. PROBLEMS IN THE ELECTRICAL DESIGN OF VERY HIGH
ENERGY SYSTEMS

K.B. Riepe and R.E. Stappleton
Los Alamos National Lab., Los Alamos, NM 87545
Mo. CONF-731114-40, 17p (01/1973).

Availability: LA-UR-73-1630
NTIS

For abstract, see NSA 29 06, number 15151.

Primary Keywords: Lasers; Electron Beams; Efficiency; Energy Transfer;
Excitation; Pulse Generators; Specifications

Secondary Keywords: AEC

10458

SUSCEPTIBILITY OF PULSE NUCLEAR MEASURING EQUIPMENT TO ELECTRICAL
INTERFERENCES

J. Buisson
CEA Centre d'Etudes Nucléaires, Saclay, France 92260
(02/1973).

Availability: CEA-R-4425
NTIS

For abstract, see NSA 28 01, number 00568.

Primary Keywords: Pulse Circuits; Interference; Measuring
Instruments; Interference; Electric Currents;
Variations

Secondary Keywords: AEC

Distribution Restriction: IN FRENCH. U.S. SALES ONLY.

10459

SHOP DRAWINGS FOR A MEDIUM SIZE MARX GENERATOR: TECHNICAL REPORT NO.
73-009

M.S. Risk
University of Maryland, College Park, MD 20742
(08/1972).

Availability: DRD-2504-184
NTIS

For abstract, see NSA 27 06, number 14416.

Primary Keywords: Pulse Generators; ELECTRONICS
Secondary Keywords: AEC

10460

HIGH-VOLTAGE PULSE GENERATORS FOR STREAMER CHAMBERS
M.M. Kulyukin, D.B. Fontekorva, V.M. Seroka, I.V. Felomkin and Y.A.
Shcherbakov
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear
Problems.
(01/1972).

Availability: JINR-P13-6933
NTIS

For abstract, see NSA 26 21, number 58698.

Primary Keywords: Pulse Generators; ELECTRONICS; Radiation Detectors/
Spark Chamber

10461

GENERATOR OF EXTENDED DURATION HIGH VOLTAGE PULSES
J. Gaucher and G. Roux
CEA Centre d'Etudes Nucléaires, Saclay, France 92260
(02/1972).

Availability: CEA-M-1916
NTIS

For abstract, see NSA 26 17, number 49984.
Primary Keywords: Pulse Generators; ELECTRONICS

10462

ELECTRON BOMBARDED SEMICONDUCTOR SHORT PULSE GENERATOR

A. Silvers
Watkins-Johnson Co., Palo Alto, CA

Triannual rept. no. 5, 1 Dec /1-31 Mar 72 (09/1972).

Availability: AD-748 098
NTIS

Improved fabrication processes for large area semiconductor
targets and complete high current amplifiers were developed. Large
area (1.40 sq. cm active area) semiconductor diodes, with leakage
current of less than 10 mA at reverse bias voltages of 250 volts were
fabricated. Initial tests were made on a completely processed tube
with an internal getter instead of a two liter upper degas pump. Three
complete high current pulse amplifiers were fabricated and tested for
diode saturation characteristics and pulse performance. The
performance was determined for both grid-driven and cathode-driven
operation. (Author)

Primary Keywords: Pulse Amplifiers; Design; Pulse
Generators; Performance(Engineering); Electron Tube
Targets; Semiconductors; Electron Guns;
Diodes(Semiconductor); Silicon; Manufacturing Methods

10463

MULTITUBE GENERATOR BANK

G.I. Zverev, V.L. Lyulev, V.B. Maliburov, I.S. Savchenko and I.R.
Yampolskii
Joint Publications Research Service, Arlington, VA
(04/1972).

Availability: JPRS-56371
NTIS

Four-phase tube generators for excitation of the circuits shaping
the high-frequency fields of various configurations used in plasma
physics research are described. The generators can operate in two
modes: independent excitation and autooscillation. The
autooscillation mode (the load is the lightning circuit). The
total installed power per bank tube is about 88
megawatts per pulse lasting 1-1.5 milliseconds with a duty cycle
frequency of 0.5 to 2 megahertz and a pulse repetition rate of 0.05
to 0.1 hertz. The problem of obtaining high power is solved by
adding the powers of groups of generator tubes included in parallel
in the load. (Author)

Primary Keywords: Pulse Generators; Design; Plasma(Physics); Pulse
Generators; Tube Components; Voltage Regulators;
Translations; USSR

10464

(DIAGNOSTICS AND INSTRUMENTATION)

(Power)
KDS AND BKD CALORIMETRIC ENERGY METERS FOR HIGH-POWER LASER PULSES
Soviet Journal of Quantum Electronics, Vol. 8, No. 3, pp 419-420
(03/1978).

Trans. From: Kvantovaya Elektronika (Moscow), Vol. 3, pp 709 (March
1979)

Primary Keywords: Thermal Radiation Detectors; Thermoelectric Battery;
High Damage Threshold; Specifications Given
COPYRIGHT: 1978 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

10465

(PARTICLE BEAMS, ELECTRON)

(Generation)

MICROSECOND MEGAJOULE ACCELERATOR FOR BEAM INDUCED THERMONUCLEAR
MICROEXPLOSIONS

F. Winterburg
Univ. Of Nevada, Reno, Nevada

Nuclear Instruments And Methods 156 (1976), pp 437-440 (12/1976).
A novel concept for an intense relativistic beam accelerator is
proposed which can deliver megajoule energies on the time scale of
one nanosecond with a total beam power of 10¹⁵ W thereby reaching
conditions as they are required for the ignition of thermonuclear
microexplosions. 11 Refs.

Primary Keywords: One Hz Pulse; 10¹⁵ W Beam Power; Ignition Of
Thermonuclear Microexplosions; Transmission Line
Type Accelerator

COPYRIGHT: 1976 THE NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH
PERMISSION

10467

(INSULATION, MAGNETIC)

()

ONE- AND TWO-SPECIES EQUILIBRIA FOR MAGNETIC INSULATION IN COAXIAL
GEOMETRY

K.D. Bergeron
Sandia Labs, Albuquerque, NM 87115

The Physics of Fluids, Vol. 20, No. 4, pp 688-697 (04/1977).
A cold-fluid, self-consistent model of electron and ion flow in
coaxial cylindrical geometries is applied to the problem of
magnetically insulated diodes. The one species, nonrelativistic
problem is studied to determine what configurations and parameter
domains equilibria corresponding to magnetic insulation exist. It is
proved that when the outer electrode is the cathode, equilibria
exist even if there is no inner cathode, whether or not equilibria exist
and where they are located depend on the width of the gap, the azimuthal
or longitudinal and on the ratio of the radii. The two-species
relativistic problem is then analyzed with the help of a
computational routine which integrates the cold-fluid differential
equations and searches the parameter space for the point
corresponding to space charge limited emission. As the critical field
is approached from above, the resulting values of ion current show an
enhancement over the single species prediction by a factor which
increases with voltage and with anode radius. Patterns of
nonexistence of equilibria similar to those observed for the
one-species, nonrelativistic case are also found. 17 Refs.

Primary Keywords: Cylindrical Magnetically Insulated Diodes; Cold-fluid;
Self-consistent Model; Electron And Ion Flow;
Determination Of An Equilibrium Exist; Outer
Cathode; Inner Cathode; Space Charge Limited
Emission; Critical Field Enhancement

COPYRIGHT: 1977 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH
PERMISSION

10468
(PARTICLE BEAMS, ELECTRON)
(Diagnostics)

POTENTIAL OF A HOLLOW ELECTRON BEAM IN A MAGNETICALLY-INSULATED DIODE
S.P. Bugayev, A.A. Kim and V.I. Koshelev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics Technical Physics, Vol. 24, No. 8, pp 1007-1008
(08/1979).
Trans. from: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 1790-1792
(August 1979)
9 Refs.

Primary Keywords: Magnetically Insulated Diode; Microsecond Accelerator; Potential Of A Hollow Electron Beam; Capacitive Voltage Divider; Graphite Collector; Burke Circuit; Plasma Propagation Velocity

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10469
(POWER TRANSMISSION)
(Transmission Lines)

PROPAGATION OF POWER PULSES IN MAGNETICALLY INSULATED VACUUM TRANSMISSION LINES

M.S. Di Cesare and D.G. Fellin
Physics International
Journal of Applied Physics, Vol. 50, No. 5, pp 3713-3720 (05/1979).
25 Refs.

Primary Keywords: Magnetically Insulated Vacuum Lines; 1.8 MV, 80 KA Pulse; 41.6 Ohm Line; 4ns Risetimes; Peak Power Density 2x10e9 W/cm²; Line Wave Impedance; Line Effects On Pulse Shape; Optimal Termination; Reflected Waves

COPYRIGHT: 1979 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10470
(BREAKDOWN STUDIES)

(Exploding-Wire)

RADIATION FROM A DENSE PLASMA GENERATED BY AN EXPLODED WIRE IN VACUUM
E.K. Cheshkin and V.S. Shumanov
G.M. Krzhizhanovskii: Power Engineering Institute, Moscow, USSR
Soviet Physics Technical Physics, Vol. 14, No. 1, pp 46-48 (07/1969).
Trans. from: Zhurnal Tekhnicheskoi Fiziki, Vol. 39, No. 1, pp 71-74
4 Refs.

Primary Keywords: Optical And Spectral Properties; Copper And Aluminum Wires; 30 KV, 41 uF Capacitor Bank

COPYRIGHT: 1969 AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10471
(PARTICLE BEAMS, ELECTRON)

(Generation)

DC-PK CURRENT IN MICROSECOND HIGH-CURRENT MAGNETICALLY INSULATED DIODES
N.S. Di Cesare, A.A. Kim and V.I. Koshelev
Academy of Sciences of the USSR, Tomsk, USSR
Soviet Physics Technical Physics, Vol. 24, No. 8, pp 924-925 (08/1979).
Trans. from: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 1659-1661
(August 1979)
5 Refs.

Primary Keywords: High Voltage Diodes; Magnetic Insulation; Return Current; Reduced Efficiency; Explosive Electron Emission; Electron Space Charge

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10472
(BREAKDOWN STUDIES)

(Solid, Radiation)

SCEMP RESPONSE INVESTIGATION WITH EXPLODING-WIRE PHOTONS, PART II
R. Stettner (1), B.M. Goldstein (1), V.A.J. Van Lint (2) and D.A. Fromme (2)
(1) Mission Research Corporation, Santa Barbara, CA 93101
(2) Mission Research Corp., La Jolla, CA
IEEE Transactions On Nuclear Science, Vol. NS-25, No. 6, pp 1342-1348
(12/1978)
7 Refs.

Primary Keywords: SCEMP; Exploding Wires; Discrepancies From Part I; Resolved; Peak Skin Currents; Monopole Experiment; Dissemeter Materials Experiment

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

10473
(PARTICLE BEAMS, ELECTRON)

(Generation)

STRUCTURE OF THE HIGH-CURRENT RELATIVISTIC ELECTRON BEAM FORMED BY A COAXIAL GUN WITH MAGNETIC INSULATION
M.A. Gorshkova, V.P. Litvin, V.M. Nechaev, V. Sveshnikov and M.I. Fuks
Academy of Sciences of the USSR, Gor'kiy, USSR
Soviet Physics Technical Physics, Vol. 25, No. 1, pp 63-66 (01/1980).
Trans. from: Zhurnal Tekhnicheskoi Fiziki, Vol. 50, pp 109-114
(January 1980)

A numerical solution is reported for the problem of the formation of a high-current beam of relativistic electrons in a coaxial diode gun with magnetic insulation. The beam structure and other basic characteristics are analyzed in comparison with experimental results and analytic solutions based on models. 15 Refs.

Primary Keywords: Magnetic Insulation; Coaxial Gun; Numerical Solution; Comparison Of Numerical Solution With Experimental Results

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS. REPRINTED WITH PERMISSION

10474
(BREAKDOWN STUDIES)

(Gas, Electrical)

TECHNICAL PROBLEMS INVOLVED IN H/SUB 2/ STREAMER CHAMBERS

F. Rohrbach (1), J.J. Bonnet (2) and M. Cathenoz (3)

(1) Univ. Of Washington, Seattle, Washington

(2) C.E.A.-M. Paris, France

(3) CERN, Geneva, Switzerland

Nuclear Instruments And Methods 111 (1973) pp 485-495 (01/1973).
15 Refs.

Primary Keywords: H/Sub 2/ Streamer Chambers; Blumlein Line; Brief Pulse; High, Reproducible Field; Additional Impurities; Marx Generator Miniaturization

COPYRIGHT: 1973 THE NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

10475
(PULSE GENERATORS)
(Linear Amplifiers)

A LOW-COST SUB-NANOSECOND PULSE AMPLIFIER
M. Moore, G. Newton and P. Pollard
University of Sussex, Sussex, UK
Nuclear Instruments And Methods, Vol. 115, pp 181-184 (01/1973).
Fast amplifiers for short-duration nanosecond pulses are described. These provide a bandwidth which is near the limit obtainable with conventional construction techniques and discrete component. Each has a gain of approximately 3.3 and a rise time of 0.7 ns. An output of between 0.5 and 1 V into 50 ohms is achieved. 1 Refs.

Primary Keywords: Compact Layout; UHF Wiring Techniques; 50 Ohm Output Impedance; Inverted Output; PNP Or NPN Types; Decoupled Power Supplies

COPYRIGHT: 1974 THE NORTH-HOLLAND PUBLISHING CO., REPRINTED WITH PERMISSION

10476
(DIAGNOSTICS AND INSTRUMENTATION)

(Partial Discharges)

A SIMPLE PULSE-HEIGHT ANALYZER FOR PARTIAL-DISCHARGE-RATE MEASUREMENTS
B. Bartnikas and J.H.E. Levi
Research And Development Labs, Ottawa, Ontario, Canada
IEEE Transactions On Instrumentation And Measurements, Vol IM-18, No. 4, pp 581-585 (12/1969).
7 Refs.

COPYRIGHT: 1969 IEEE. REPRINTED WITH PERMISSION

10477
(PULSE GENERATORS)

(Miscellaneous)

A TECHNIQUE FOR VERY-HIGH-SPEED PULSE GENERATION WITH VARIABLE REPETITION RATE

J.A. Cookin (1) and R.J.F. Dow (2)
(1) University of Southampton, Southampton, UK
(2) James Cook University, Townsville, Queensland, Australia
Proceedings Of The IEEE, (June 1974), pp 852-853 (06/1974).

A simple technique is proposed for the generation of high-speed variable repetition rate pulse trains by summing the output pulses from a series of variable delay step recovery diode circuits. The diode switching times determine the maximum repetition rate, which is several gigahertz. 1 Refs.

Primary Keywords: Step Recovery Diode Circuit; Multistage System; Delay Lines; Common Base Transistor As Summer

COPYRIGHT: 1974 IEEE. REPRINTED WITH PERMISSION

10478
(PULSE GENERATORS)

(Capacitive)

AN ELECTROMAGNETIC, PLANE STRESS-WAVE GENERATOR

R.F. Snell (1), DC MacKellar Jr. (1) and R. Guernsey (2)

(1) McDonnell Douglas Astronautic Company, Huntington Beach, CA

(2) Knolls Atomic Power Labs, Schenectady, NY

Experimental Mechanics, (November 1973), pp 472-479 (11/1973).
This paper describes a unique device that has been developed for the transient loading of models along straight and curved boundaries and that operates by discharging a high-energy, high-voltage capacitor bank. In its present configuration, this device can generate uniform pressure from 1500 psi (10 MPa) to pressures that approach 100,000 psi (690 MPa) and that rise from zero to maximum pressure in 2 us and decay to approximately zero in another 2 us. The transient stress-wave patterns in photoelastic models loaded with this device have been recorded by a dynamic polariscope. The dynamic polariscope presently in use is identical to a static polariscope except that the light source is of a short enough duration (1/2 us) to photographically stop the movement of the photoelastic-fringe patterns caused by the stress wave. With the stress-wave generator and the dynamic polariscope transient photoelastic patterns have been recorded in a number of models. These patterns indicate that the scatter from duplicate shots performed with this technique is on the order of 3 percent. This represents considerable improvement over the 15 percent scatter normally experienced with sheet-explosive loading techniques. This improvement and the rapid turnaround between shots (approximately 5 min) are distinct advantages this system has over other methods of dynamic loading. 17 Refs.

Primary Keywords: 1500 psi To 100,000 psi; Pressure Pulse, 2 us Rise And Decay Time; Low Scatter; Spark Gap Trigger

COPYRIGHT: 1973 THE SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS.
REPRINTED WITH PERMISSION

10479
(PULSE GENERATORS)

(Line Type)

AVALANCHE TRANSISTOR PULSER FOR FAST-GATED OPERATION OF MICROCHANNEL PLATE IMAGE-INTENSIFIERS

A. Lundy, J.R. Parker, J.S. Lunsford and A.D. Martin

Los Alamos National Labs, Los Alamos, NM 87545

IEEE Transactions On Nuclear Science, Vol. NS-25, No. 1, pp 591-597 (02/1978).

Transistors operated in the avalanche mode are employed to generate a 1000 volt, 10 to 30 nsec wide pulse with < 4 nsec rise and fall times. This pulse is resistively attenuated to ~ 270 volts and drives the image intensifier tube which is a load of ~ 200 pf. To reduce stray inductance and capacitance, transistor chips were assembled on a thick-film hybrid substrate. Circuit parameters, operating conditions, and coupling to the microchannel plate image-intensifier (MCP12) tube are described. To provide dc operating voltages and control of transient voltages on the MCP12 tube a resistance-capacitance network has been developed which (a) places the MCP12 output phosphor at ground, (b) provides programmable gains in f-stop steps, and (c) minimizes voltage transients on the MCP12 tube. 12 Refs.

Primary Keywords: Avalanche Pulser; 2N3700 Transistors (National Semiconductor Corporation); Low Jitter

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

10480
(PULSE GENERATORS)

(Miscellaneous)

EFFECT OF DISSOCIATION PULSE CIRCUIT INDUCTANCE ON THE CuCl LASER

A.A. Vetter (1) and N.M. Narheim (2)

(1) California Institute of Technology, Pasadena, CA

(2) Jet Propulsion Lab, Pasadena, CA

IEEE Journal Of Quantum Electronics, Vol. QE-14, No. 2, pp 73-74 (02/1978).

The performance of the double-pulsed CuCl laser is improved by a decrease in the inductance of the dissociation pulse circuit. Higher efficiency is obtained due to a larger ground state copper atom population and lower optimum dissociation energy. 4 Refs.

COPYRIGHT: 1978 IEEE. REPRINTED WITH PERMISSION

262

10481
(POWER TRANSMISSION)
(Transmission Lines)
ENV AC PARALLEL TRANSMISSION LINE CALCULATIONS WITH APPLICATION TO THE NEAR RESONANCE PROBLEM
A. Cheston
Brigham Young University, Provo, UT
IEEE Transactions On Power Apparatus And Systems, Vol. PAS-88, No. 5, pp 627-634 (05/1989).

The use of shunt reactors with EMV transmission lines has introduced new problems, one of which is induction of high voltages on a de-energized circuit of two parallel lines. This paper presents the matrix equations used in developing a digital computer program which takes into account the effects of electromagnetic induction, electrostatic coupling, distributed lines, and transposition. The computer program may also be used to calculate the effects of shunt reactors, series capacitors, and loads. The equations can be adapted to a wide range of applications, although the examples for this paper have been limited to the near resonance problem of parallel transmission lines. 9 Refs.

Primary Keywords: Parallel Lines; Matrix Equations; Digital Computer; Electromagnetic Induction; Electrostatic Coupling; Distributed Lines; Transposition; Shunt Reactors; Series Capacitors; Loads

COPYRIGHT: 1989 IEEE, REPRINTED WITH PERMISSION

10482
(PARTICLE BEAMS, ELECTRON)
(Generation)
ELECTRICALLY DRIVEN 200-JOULE PULSED LASER
H.G. Basov, V.A. Danil'ychev, A.A. Ionin, I.B. Kovsh and V.A. Sobolev
Academy of Sciences of the USSR, Moscow, USSR
Soviet Physics Technical Physics, Vol. 18, No. 11, pp 1488-1491 (05/1974).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 43, pp 2357-2363
An electrically driven CO₂ laser with a working volume of 10 liters at gas pressures up to 3 atm is described; an electron gun with a multitube cathode is used to ionize the active medium. The energy deposited in the working gas, the output power, and the efficiency are investigated for various mixture compositions and pressures. Emission pulses of 200 J are obtained with a pressure of 760 torr and a 1.5:1.4 mixture of CO₂:N₂:He. 11 Refs.

Primary Keywords: CO₂ Laser; Output Power; Efficiency; 10 Liter Working Volume; Multitube Cathode; Marx Generator (12nF, 200kV)

COPYRIGHT: 1974 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10483
(BREAKDOWN STUDIES)
(Gas, electrical)
HIGH-CURRENT DISCHARGES IN NITROGEN WITH AN INFINITE STORAGE BANK
E.A. Azarov, A.A. Bogomaz, B.P. Luvchenko, F.C. Fuerberg and V.A. Yaginov
All-Union Institute, Leningrad, USSR
Soviet Physics Technical Physics, Vol. 24, No. 2, pp 255-256 (02/1979).

Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 441-443
In this note we report an experimental study of a high-current high-pressure discharge in nitrogen initiated by an exploding-wire. The initial stage of discharges of this kind has been studied in Refs. 1-3. 2 Refs.

Primary Keywords: Inductive Storage Bank Supply; Electrodes; Exploding Wires; Pulsed Pressure; Temperature

COPYRIGHT: 1979 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10484
(SWITCHES, CLOSING)
(Gas Gases, Optical)
INVESTIGATION OF THE INFLUENCE OF THE DISCHARGE MEDIUM ON THE CHARACTERISTICS OF LASER-RADIATION-TRIGGERED DISCHARGE GAPS
L.N. Bykovskaya
All-Union Institute, Moscow, USSR
Soviet Journal Of Quantum Electronics, Vol. 9, No. 10, pp 1242-1245 (10/1979).

Trans. From: Kvantovaya Elektronika(Moscow), Vol. 6, pp 2117-2121
The results are presented of investigations of new current discharge gaps, having operating voltages of 9-7 and 20-16 kV and filled with various gas mixtures (argon and nitrogen, pure nitrogen). The dependences are given of the delays in firing the gaps, as a function of the voltage of the electrodes and of the energy of the laser pulses used for triggering ($\lambda = 1.06 \mu\text{m}$). The minimum triggering energy of the typical discharge gaps was 2 uJ, when using a radiation pulse having $(\lambda = 1.06 \mu\text{m})$. The rise time of the voltage pulse produced was 0.5 nsec. The discharge gaps were used to control electro-optic switches in laser systems. A study is made of the resistor produced during the breakdown of the discharge gaps. The radiation pulse had a flat top with a rise time of ~ 1 nsec. 8 Refs.

Primary Keywords: Current Gaps; Argon And Nitrogen Vs. Pure Nitrogen

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10485
(INSULATION, MAGNETIC)
(λ)
MAGNETIC INSULATION OF AN INTENSE RELATIVISTIC ELECTRON BEAM
J. Gallo, J.J. Czachowski and G. Rehfuß
Massachusetts Institute of Technology, Cambridge, MA
Journal of Applied Physics, Vol. 49, No. 7, pp 3211-3212 (07/1978).
A magnetic field is used as an insulator to prevent electrons from crossing the gap of a pulsed field-emission diode subjected to voltages of 100-250 kV. The diode is comprised of two concentric cylinders with variable gap separation ranging from 2 to 6 mm. A pulsed magnetic field up to 15 kG is applied along the diode axis. When the magnetic field exceeds a certain critical value, the electron current (which is typically 10-30 kA) is reduced by approximately two orders of magnitude. The desired magnetic insulation lasts over the full 50 nsec voltage pulse. 12 Refs.

Primary Keywords: Intense E-beam; 100-250kV; Magnetic Field Up To 15kG; 50ns Pulse Length; Pulsed Field Emission Diode

COPYRIGHT: 1978 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10486
(BREAKDOWN STUDIES)
(Solids, Electrical)
MECHANISM FOR A SECONDARY SURFACE BREAKDOWN IN A REVERSE BIAS HIGH-VOLTAGE SILICON P-N JUNCTION
S.M. Atayev, I.V. Greshkov, M.A. Magomedov and Sh.R. Mutalibov
Academy of Sciences of the USSR, Makhachkala, USSR
Soviet Physics Technical Physics, Vol. 24, No. 8, pp 992-993 (08/1979).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 49, pp 1768-1770
4 Refs.

Primary Keywords: Photomultiplication; Electroluminescence Spectrum; 700-1500V; 10⁻⁵ to 10⁻⁶ sec Excitation Pulses; Air vs. Vacuum

COPYRIGHT: 1980 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10487
(ELECTROMAGNETIC COMPATIBILITY)
(Hardness)
MODAL CHARACTERIZATION OF SKYNET RESPONSE TO ELECTRICAL AND PHOTON STIMULATION
V.A.J. Van Lint and D.A. Iromme
Mission Research Corporation, La Jolla, CA 92038
IEEE Transactions On Nuclear Science, Vol. NS-26, No. 6, pp 4989-4999 (12/1979).
0 Refs.

Primary Keywords: Structure Currents; Calculated Response; Model Descriptions; Exploding Wire Radiator Photon Excitation; Internal Sensor Response

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

10488
(BREAKDOWN STUDIES)
(Vacuum, Electrical)
PLASMA BUILDUP AND BREAKDOWN DELAY IN A TRIGGERED VACUUM GAP
A.J. Green (1) and C. Christopoulos (2)
(1) University of Durham, Durham, UK
(2) University of Nottingham, Nottingham UK
IEEE Transactions On Plasma Science, Vol. 7, No. 2, pp 111-115 (06/1979).

The phenomena leading to the surface flashover across solid insulators in vacuum and the subsequent spread of the trigger plasma thus formed to bridge the main gap in a triggered vacuum switch are investigated experimentally. The results show that the breakdown proceeds in two stages. In the first stage a plasma is formed by electrons releasing and ionizing absorbed gases. The electrons are field emitted at the insulator-electrode junction and the breakdown delay is primarily affected by the trigger voltage. In the second stage the trigger plasma expands into the main gap with a speed depending on the trigger current and trigger electrode geometry, in accordance with a simple model. 14 Refs.

Primary Keywords: Time Delay; Flashover Mechanism; Expansion Of The Trigger Plasma

COPYRIGHT: 1979 IEEE, REPRINTED WITH PERMISSION

10489
(PULSE GENERATORS)
(Miscellaneous)
SINGLE-CHIP PULSE GENERATOR PROVIDES 50 MHZ WITH ADJUSTABLE DUTY CYCLE
W.A. Palm
Control Data Corporation, Minneapolis, MN 55435
Electronic Design, Vol. 26, pp 72 (12/1976).
0 Refs.

Primary Keywords: MC1014; 50 Ohm Output Impedance

COPYRIGHT: 1975 THE HAYDEN PUBLISHING COMPANY, REPRINTED WITH PERMISSION

10491
(SWITCHES, CLOSING)
(Liquid, Self)
SWITCHING CHARACTERISTICS OF A DISCHARGE IN WATER
V.M. Kuleshov, S.L. Nedosekov, V.P. Smirnov and A.M. Spivak
Soviet Physics Technical Physics, Vol. 19, No. 1, pp 158-151 (07/1974).
Trans. From: Zhurnal Tekhnicheskoi Fiziki, Vol. 45, pp 230-232
The switching characteristics of discharge gaps are studied in water as a function of the characteristic impedance of the shaping line $Rho_{sub 0}$ over the range 2.5-39 Ohms. A line with an electrical length of 50 nsec is charged to < 120 kV. Most of the experiments are carried out at fields up to 100 kV/cm. The minimum rise time, $Tau_{sub R}$, $Rho_{sub 0} / sub R$ = 7 nsec, and the maximum rate of current increase, $I / Tau_{sub R}$, $Rho_{sub 0} / sub R$ = 10E2 A/sec, are detected with $Rho_{sub 0}$ = 13 Ohms. Up to 50% of the energy stored in the line is absorbed in the switch during a pulse. The operation remains qualitatively the same with a voltage of 400 kV on a line with $Rho_{sub 0}$ = 15 Ohms. 5 Refs.

Primary Keywords: High Power Shaping Lines; Breakdown 2 10E6V/cm; 7ns Risetime

COPYRIGHT: 1974 THE AMERICAN INSTITUTE OF PHYSICS, REPRINTED WITH PERMISSION

10492
(PULSE GENERATORS)
(Systems)
SYSTEM FOR CALIBRATION OF SPEAR TRANSPORT LINE TOROIDS
T.Y. Huang, H. Smith and K. Crook
Stanford University, Stanford, CA 94305
IEEE Transactions On Nuclear Science, Vol. NS-24, No. 3, pp 1748-1750 (06/1977).
A one nanosecond pulse generator has been developed for calibration of the intensity monitors (toroids) in the SPEAR transport lines. The generator, located at the toroid, is simple, low cost and resistant to radiation. This paper describes the generator, and its connection to the standard SLAC toroid calibration system. 0 Refs.

Primary Keywords: 1ns Local Generator At Each Toroid

COPYRIGHT: 1977 IEEE, REPRINTED WITH PERMISSION

10493
(PULSE GENERATORS)
(Miscellaneous)
WIDE-BAND PULSE AMPLIFIER
I. Meyer
Siemens-Antiagesellschaft, Munich, Germany
IEEE Journal Of Solid State Circuits, Vol. SC-13, No. 3, pp 409-411 (06/1978).
In order to build a gigabit/second pulse amplifier for medium power applications a new transistor-distributed amplifier configuration was developed and tested. A five-section amplifier employing 5 GHz fT bipolar transistors has a frequency response from dc to 3.6 GHz. Results achieved were a 10 db gain, 130 ps step response rise time, and an amplitude of 4 V peak to peak across a 50 Ohm load. 4 Refs.

Primary Keywords: DC To 3.6 GHz Response; Bipolar Transistors;

Five-section

COPYRIGHT: 1978 IEEE, REPRINTED WITH PERMISSION

10494
(DIAGNOSTICS AND INSTRUMENTATION)
(Miscellaneous)
A BACK-MATCHED DELAY-LINE CLIPPING TECHNIQUE FOR USE WITH FAST AMPLIFIERS
B. Griffiths and Z.C. Tan
University of Auckland, Auckland, New Zealand
Proceedings Of The IEEE, May 1975, pp 820 (05/1975).
A modified delay-line clipping amplifier technique which overcomes the drift and low-frequency noise problems of conventional dc-coupled pulse amplifiers is proposed. This technique results in an amplifier system with low output reflection coefficient and excellent overload recovery characteristics. 0 Refs.

Primary Keywords: Delay Line Clipping Amplifier Technique; Low Output Reflection Coefficient; Low Noise And Drift Characteristics

COPYRIGHT: 1975 IEEE, REPRINTED WITH PERMISSION

END

FILMED